Create CD-ROMs on Your Desktop

Low-Cost Recorders Ignite CD Publishing

PLUS
BYTE Rates 17
Mac Accelerators
Multi-Lingual Scholar: 63-Language Word Processor
Pournelle:
Windows for Workgroups vs. LANtastic
What Do You Wish For In A PC?
Your wish is our command at Gateway 2000! We can grant you the three most universal PC wishes in the wink of an eye. As a fringe benefit, we won’t limit you to three wishes here. Most anything your heart desires in computers (sorry, we can’t grant wishes for romance or riches), you can get from Gateway.

That’s because we built our business by listening to our customers’ wishes and doing everything in our power to make their dreams come true. At Gateway, we believe you should be able to have it all: the latest technology, glittering performance, quality construction, enchanting service and the fairest prices in the land. All this from a financially healthy company that won’t run dry and leave you stranded in the desert.

You don’t have to settle for less. With Gateway 2000, you can have it all. Draw up your wish list and give us a call. We’ll make some truly magical values materialize for you.
Your Wish Is Our Command!

"I wish I could get a great PC at a great price without sacrificing performance and features." Your wish is our command!

You'll be spellbound by Gateway's ferociously competitive prices on systems that are unequaled in powerful performance, impressive features and graceful integration of components. When readers and editors of the most popular PC magazines are asked which company delivers on its promises, their overwhelming response is Gateway 2000.

"Gateway has gone far beyond conventional ideas of price and performance ... it has created new rules that other PC makers will have to follow if they want to remain players."

– PC Computing, 1992 MVP Awards

"Gateway 2000 was the big 1992 Best Buy winner, sweeping not only the desktop awards as it did last year, but the newly expanded notebook categories as well ... Altogether, Gateway won five Best Buy awards this year, including Best Overall System Vendor ... It's no surprise that Gateway is consistently the people's choice when it comes to systems."

– Computer Shopper, 1992 Readers' Best Buy Awards
“I wish I could be sure I’m buying from a PC company that will provide excellent service and support - a company that will be around for me.” Your wish is our command!

Twice in 1992, Gateway was honored for outstanding service. *PC World* readers ranked Gateway number one in service and support. And *PC Magazine* readers gave Gateway the best overall scores in the 1992 Service and Reliability Survey.

Just as important is our strength as a company. Warranties and assurances of lifetime technical support don’t mean anything unless a company survives to honor them, which is a serious consideration in the shifting sands of today’s PC marketplace.

Gateway is among the few financially robust companies in the industry. Our 1992 revenues exceeded $1 billion and our earnings are among the strongest in the industry. The company is virtually debt-free. At a time when other companies have been forced to lay off employees, we added 300 people to our staff. You now have 1,800 friends in the business. Rest assured Gateway is your oasis that will never leave you high and dry. We’ll be here for you!

“I wish I could find the combination of features I need in a portable PC - at the right price.” Your wish is our command!

No matter what you need in a portable, you’ll find it in one of our Nomad models or in the Gateway HandBook.” Gateway customers selected Nomads as the winners in 386 and 486 notebook categories of *Computer Shopper’s* 1992 Best Buy Awards.

“There are faster laptops, there are cheaper laptops, there are color laptops, but there is no better laptop ... Weighing in at only 5.6 pounds, the Nomad combines the powerful punch of a 25MHz i486DX with a working battery life of more than six hours. At long last, we have a laptop that can really go the distance when there’s no power outlet in sight.”

– *Computer Shopper*, 1992 Readers’ Best Buy Awards

The Gateway 2000 HandBook was recognized by *Popular Science* magazine as one of the “Best of What’s New” products of 1992, also received *BYTE* magazine’s Award of Distinction.

*PC Computing* describes the HandBook as “an engineering marvel.” *PC Week* agrees. “Gateway’s HandBook is just about as small as a fully functional portable can be.”
Our Caravan Of Extras.

Software Selections
Your every software need is our command. With mini desktop, desktop and tower systems that include "choice of application software," select one of the following applications, all latest versions:

- Microsoft® Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf 92®, CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The MS Entrepreneur Pack (Works™, Publisher™, Money™, and games)
- Borland Paradox® or dBASE IV®
- The Windows Programmer Pack (MS Quick C™, Visual Basic and more)
- Upgrade to Microsoft Office™ for $175

Free Utilities
Cool Tools for DOS, a diagnostic and utilities package, comes with all Gateway desktop systems and includes:

- QA Plus™ from Diagsoft™
- Central Point® Anti-Virus, RAM Boost, Defrag and Emergency Disk

Microsoft Windows™ for Workgroups
Windows for Workgroups is ideal for e-mail, group scheduling and resource sharing, and includes an Ethernet adapter and software. Plus the hardware and software is factory-installed. You can see Windows for Workgroups running on Gateway systems in any of over 200 Egghead Software® stores in the U.S. Stop by for a demonstration!

$159

Microsoft Windows Sound System™
This sound system designed especially for business use lets you speak to your PC for hands-free operation. It even reads numbers back to you for proofing. You can also embed audio messages in all your Windows OLE applications. Package includes soundboard, microphone, headset and software.

$149

CD-ROM Kit
Includes interface card and everything you need to add CD-ROM to your PC. It's MPC-compliant and manufactured for us by Sony.

$225

The TelePath™ Fax/Modem
A 14,400bps modem, V.32bis, with 9,600bps fax capability. Includes WinFax Pro™, Crosstalk™ for Windows, Qmodem™ and more.

$195

CrystalScan™ 15-Inch Monitor
Non-interlaced 15-inch color monitor with flat, square screen – an upgrade option with the purchase of any Gateway 2000 desktop system.

$100 (to upgrade from 14-inch 1024NI)

Panasonic Color-Capable Printer
Add color to your documents with this Panasonic KXP2123 24-pin dot matrix printer. Includes Adobe Type Manager®

Printer, $259; Color Option, $50

Most Gateway peripherals are sold only with the purchase of a Gateway system.

For details on our complete line of components, peripherals and software, call direct to our special add-on components division at 800-252-3333.
### Gateway 2000's Magical Values

#### DESKTOP SYSTEMS

<table>
<thead>
<tr>
<th>3SX-25</th>
<th>4SX-25</th>
<th>4SX-33</th>
<th>4DX-33</th>
</tr>
</thead>
<tbody>
<tr>
<td>25MHz 386SX Intel® Processor*</td>
<td>25MHz 486SX Intel Processor*</td>
<td>33MHz 486SX Intel Processor*</td>
<td>33MHz 486DX Intel Processor*</td>
</tr>
<tr>
<td>4MB RAM</td>
<td>4MB RAM</td>
<td>4MB RAM</td>
<td>4MB RAM, 64K Cache</td>
</tr>
<tr>
<td>5.25” &amp; 3.5” Diskette Drives</td>
<td>5.25” &amp; 3.5” Diskette Drives</td>
<td>5.25” &amp; 3.5” Diskette Drives</td>
<td>5.25” &amp; 3.5” Diskette Drives</td>
</tr>
<tr>
<td>80MB IDE Hard Drive</td>
<td>170MB IDE Hard Drive</td>
<td>170MB IDE Hard Drive</td>
<td>250MB IDE Hard Drive</td>
</tr>
<tr>
<td>Windows Accelerated Video with 1MB DRAM</td>
<td>Windows Accelerated Video with 1MB DRAM</td>
<td>Windows Accelerated Video with 1MB DRAM</td>
<td>Windows Accelerated Video with 1MB DRAM</td>
</tr>
<tr>
<td>14” Color CrystalScan 1024NI</td>
<td>14” Color CrystalScan 1024NI</td>
<td>14” Color CrystalScan 1024NI</td>
<td>14” Color CrystalScan 1024NI</td>
</tr>
<tr>
<td>Mini Desktop Case</td>
<td>Mini Desktop Case</td>
<td>Mini Desktop Case</td>
<td>Mini Desktop Case</td>
</tr>
<tr>
<td>5 16-Bit ISA Slots</td>
<td>5 16-Bit ISA Slots</td>
<td>5 16-Bit ISA Slots</td>
<td>5 16-Bit ISA Slots</td>
</tr>
<tr>
<td>101-Key Keyboard</td>
<td>101-Key Keyboard</td>
<td>101-Key Keyboard</td>
<td>101-Key Keyboard</td>
</tr>
<tr>
<td>MS-DOS®, Windows® &amp; Mouse</td>
<td>MS-DOS, Windows &amp; Mouse</td>
<td>MS-DOS, Windows &amp; Mouse</td>
<td>MS-DOS, Windows &amp; Mouse</td>
</tr>
<tr>
<td>Cool Tools for DOS</td>
<td>Cool Tools for DOS</td>
<td>Cool Tools for DOS</td>
<td>Cool Tools for DOS</td>
</tr>
<tr>
<td>MS Works for Windows™ 2.0</td>
<td>MS Works for Windows 2.0</td>
<td>MS Works for Windows 2.0</td>
<td>MS Works for Windows 2.0</td>
</tr>
<tr>
<td>$1295</td>
<td>$1495</td>
<td>$1695</td>
<td>$1995</td>
</tr>
</tbody>
</table>

#### 4SX-33V

| 33MHz 486SX Intel Processor* | 33MHz 486DX Intel Processor* | 66MHz 486DX2 Intel Processor* | 66MHz 486DX2 Intel Processor* |
| 8MB RAM, 64K Cache | 8MB RAM, 64K Cache | 8MB RAM, 64K Cache | 8MB RAM, 256K Cache |
| 5.25” & 3.5” Diskette Drives | 5.25” & 3.5” Diskette Drives | 5.25” & 3.5” Diskette Drives | 5.25” & 3.5” Diskette Drives |
| 170MB IDE Hard Drive | 250MB IDE Hard Drive | 340MB IDE Hard Drive | 500MB IDE Hard Drive |
| Local Bus IDE Interface | Local Bus IDE Interface | Local Bus IDE Interface | Local Bus IDE Interface |
| VESA Local Bus ATI Ultra Pro with 1MB VRAM | VESA Local Bus 16-Bit ISA with 1MB VRAM | VESA Local Bus 16-Bit ISA with 1MB VRAM | VESA Local Bus 16-Bit ISA with 1MB VRAM |
| 15” Color CrystalScan 1572FS | 15” Color CrystalScan 1572FS | 15” Color CrystalScan 1572FS | 15” Color CrystalScan 1572FS |
| Desktop Case (Tower Upgrade) | Desktop Case (Tower Upgrade) | Desktop Case (Tower Upgrade) | Desktop Case (Tower Upgrade) |
| 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus | 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus | 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus | 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus |
| 124-Key AnyKey Keyboard | 124-Key AnyKey Keyboard | 124-Key AnyKey Keyboard | 124-Key AnyKey Keyboard |
| MS-DOS, Windows & Mouse | MS-DOS, Windows & Mouse | MS-DOS, Windows & Mouse | MS-DOS, Windows & Mouse |
| Cool Tools for DOS | Cool Tools for DOS | Cool Tools for DOS | Cool Tools for DOS |
| Choice of Application Software | Choice of Application Software | Choice of Application Software | Choice of Application Software |
| $2195 | $2495 | $2995 | $3795 |

#### PORTABLE SYSTEMS

<table>
<thead>
<tr>
<th>HANDBOOK™</th>
<th>NOMAD 425SX L</th>
<th>NOMAD 425DX XL</th>
</tr>
</thead>
<tbody>
<tr>
<td>286-Class Performance</td>
<td>25MHz 486SX Intel Processor*</td>
<td>25MHz 486DX2 Intel Processor*</td>
</tr>
<tr>
<td>1MB RAM Upgradeable to 3MB</td>
<td>4MB RAM</td>
<td>4MB RAM</td>
</tr>
<tr>
<td>40MHz Hard Drive</td>
<td>3.5” Diskette Drive</td>
<td>3.5” Diskette Drive</td>
</tr>
<tr>
<td>Backlit 7.6” CGA Screen</td>
<td>80MB IDE Hard Drive</td>
<td>120MB IDE Hard Drive</td>
</tr>
<tr>
<td>Size 5.9” x 9.75” x 1.4”, 2.75 Lbs.</td>
<td>Backlit 10” VGA Screen, 64 Grays</td>
<td>Backlit 10” VGA Screen, 64 Grays</td>
</tr>
<tr>
<td>4.5-Hr. NiMH Battery &amp; AC Pack</td>
<td>Simultaneous Video with 256K</td>
<td>Simultaneous Video with 1MB</td>
</tr>
<tr>
<td>Alkaline Battery Pack</td>
<td>Size 8.5” x 11” x 1.8”, 5.6 Lbs.</td>
<td>Size 8.5” x 11” x 1.8”, 5.6 Lbs.</td>
</tr>
<tr>
<td>1 Parallel/1 Serial Port</td>
<td>6-Hr. Nicad Battery &amp; AC Pack</td>
<td>6-Hr. Nicad Battery &amp; AC Pack</td>
</tr>
<tr>
<td>78-Key Keyboard</td>
<td>1 Parallel/1 Serial Port</td>
<td>1 Parallel/1 Serial Port</td>
</tr>
<tr>
<td>MS-DOS 5.0, LapLink® XL, MS Works™ for DOS, Central Point®</td>
<td>79-Key Keyboard &amp; FieldMouse®</td>
<td>79-Key Keyboard &amp; FieldMouse®</td>
</tr>
<tr>
<td>Desktop &amp; Serial Download Cable</td>
<td>MS-DOS 5.0 and Windows 3.1</td>
<td>MS-DOS 5.0 and Windows 3.1</td>
</tr>
<tr>
<td>Carrying Case</td>
<td>MS Works for Windows 2.0</td>
<td>MS Works for Windows 2.0</td>
</tr>
<tr>
<td>$1295</td>
<td>$1995</td>
<td>$2995</td>
</tr>
</tbody>
</table>

*Complies with Intel®EISA or Intel®EISA microprocessor

### GATEWAY2000

800-523-2000
610 Gateway Drive • P.O. Box 2000 • North Sioux City, SD 57049-2000 • 605-232-2000 • Fax 605-232-2203
Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CT)
©1992 Gateway 2000, Inc. AnyKey, Handbook, FieldMouse, CrystalScan and TelePath are trademarks of Gateway 2000, Inc. The Intel Inside® logo is a trademark and Intel is a registered trademark of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. Prices and configurations are subject to change without notice. Prices do not include shipping.
Transform Your PC With The INTERACTIVE UNIX System.
Unleash the 32-bit power in your PC with the INTERACTIVE UNIX System from SunSoft. Charge through applications at record speeds. Use real-world multitasking and networking. Get on the path to a distributed computing future.

Just Say No To SCO.
Why? The INTERACTIVE UNIX System is easy to use, simple to administer, all at a great price.
*Open Systems Today* says the INTERACTIVE UNIX "system management...is easier to use and more comprehensive" than SCO and "is simply a masterpiece of good design."

Looking Glass Professional desktop manager makes the INTERACTIVE UNIX System easy enough for novices, yet powerful enough for experienced UNIX users. And the award winning Easy Windows makes setting up graphic environments infinitely simpler.

You can't afford not to take advantage of the already low cost of the INTERACTIVE UNIX System.

And SCO UNIX/XENIX users can save an additional 50% by switching to the INTERACTIVE UNIX System today. That's something to say yes to.

Everything You Like About Your PC—And A Lot More.
INTERACTIVE UNIX System V/386 Release 3.2 supports hundreds of the most popular Intel-based platforms and peripherals. So getting started is fast, easy, and cost-effective.

Thousands of UNIX and XENIX applications are at your command. And our VP/ix package runs virtually all DOS software.


See What Develops.
The INTERACTIVE UNIX System is the environment of choice for 80x86 application development. You get access to a full range of development tools including compilers, debuggers and libraries. And for graphical applications, the X11 INTERACTIVE environment is a revelation.

Partner With Power.
The INTERACTIVE UNIX System is a powerful business partner for companies who know something about power. Companies like BMW, Goodyear, Leica, and Dunlop to name a few. That power can be yours, too. All from SunSoft, the leading supplier of 32-bit UNIX system software.

Call today and save 50% on UNIX power that's so cost-effective, it can't be anything but a PC. 1-800-227-9227.

SunSoft
A Sun Microsystems, Inc. Business

---

SunSoft, Sun Microsystems, the Sun logo, SunSoft, the SunSoft logo, VP/ix and Easy Windows are trademarks or registered trademarks of Sun Microsystems, Inc. INTERACTIVE is a trademark of INTERACTIVE System Corporation. UNIX is a registered trademark of UNIX System Laboratories, Inc. Looking Glass Professional is a trademark of Oracle Software, Inc. All other trademarks and registered trademarks are the properties of their respective owners. The promotional discount is available to SCO UNIX/XENIX users and is subject to certain restrictions. Contact SunSoft for terms and conditions of promotion. SunSoft reserves the right to stop the promotion at any time. SunSoft can be reached at 2550 Garcia Avenue, Mountain View, CA 94043. OHIO: 469-1599.

Circle 156 on Inquiry Card.
COVER STORY

FEATURE

Start the Presses
PAGE 116

NEWS

32 MICROBYTES
HP, DEC, and Sun unveil new high-powered workstations.

41 REPORT FROM LAS VEGAS
Comdex: Bigger Than Ever
by Rich Malloy
Picking the best products at the show was even harder than usual.

47 REPORT FROM ITALY
Computers Italian Style
by Andy Redfern
The Italians love stylish computers but crave innovation from abroad.

52 FIRST IMPRESSIONS
Lotus Improv for Windows
by Kenneth M. Sheldon
A radical application comes to Windows.

54 FoxPro 2.5, the cross-platform strategy begins to pay off
VideoSpigot for Windows,
SuperMatch's video-capture board
Falcon030, Atari's PC with a DSP

58 Freelance Graphics for Windows 2.0, prepare presentations painlessly
TyIN 2000, a packed adapter card
WordPerfect 5.2 for Windows, an impressive upgrade

116 Start the Presses by Jon Udell
CD-ROM publishing comes to the desktop.

FEATURES

116 Start the Presses by Jon Udell
CD-ROM publishing comes to the desktop.

AFFORDABLE CD-R Drives by Jon Udell and Howard Eglowstein

BUYING A CD-ROM DRIVE by Tom Halfhill

THE NEW BREED OF CD PLAYERS
by Ed Perratore

OPTICAL FLAVORS by Andy Redfern

139 Is ITV Here to Stay? by Cary Lu
Interactive TV's survival and prosperity are in question.

STATE OF THE ART

WIRELESS COMMUNICATIONS

146 Overview:
Wireless Mobile Communications
by John P. Mello Jr. and PeterWayner
The ability to communicate anytime, from anywhere, is almost here.

159 Stretching the Ether
by Peter Wayner
Technology expands the wireless spectrum.

169 Communications
Get Personal
by Bob Ryan
AT&T's Hobbit powers a new generation of personal communications devices.

177 Resource Guide:
Plugging into Wireless
REVIEWS

178 SOLUTIONS FOCUS
Network Fax on Tap
by Raymond GA Côté, Steve Apiki, and Stan Wszola
The BYTE Lab peers into 11 fax servers for PC, Mac, and Unix networks.

198 New Tricks for Slow Macs
by Rick Grehan
The BYTE Lab tests 17 Mac accelerator boards.

205 The Second Premiere
by Tom Yager
Premiere 2.0 for the Mac offers QuickTime movie editing at its best.

207 A BASIC Breakthrough
by Tom Yager
Visual Basic for DOS makes powerful programs easy to write.

209 Forging a Business Tool: Three Fax Software Packages for Windows
by Stan Miaskowski
Three next-generation fax software packages bring new abilities to communications.

213 Complete Communications for Small Businesses
by Stanford Diehl
A new fax and voice-mail card from Prometheus takes on the upgraded Complete Communicator.

215 Stacking Up TCP/IP for Windows
by Barry Nance
Linking Windows clients with Unix hosts via TCP/IP stacks from Beame & Wessele, Frontier Technologies, and NetManage.

219 Correspondence That Looks Good Globally
by Birrell Walsh
Multi-Lingual Scholar, a word processor for the global market.

221 Reviewer's Notebook: Retooling a Classic
by Tom Thompson
The BYTE Lab updates its Macintosh benchmarks.

HANDS ON

225 UNDER THE HOOD
The Mac Goes to the Movies
by Andrew W. Davis and Joe Burke
A detailed look at Apple's QuickTime architecture.

231 SOME ASSEMBLY REQUIRED
Handling Input Events Using C++
by Randall A. Nagy
Use the Event class to handle keyboard and mouse input across platforms.

235 SOFTWARE CORNER
A Small Browser with Everything
by Barry Nance, Tom Thompson, and Ben Smith
A powerful DOS browser, a faster Finder, and Perl-based recursive grep.

237 BEYOND DOS
A New OS/2
by Mark J. Minasi
IBM's ServicePak and the Professional Developer's Kit CD-ROM are dissected.

239 ASK BYTE
Adobe Type Manager conflicts, the Next as document manager, and more.

OPINIONS

97 USER'S COLUMN
LAN Wars
by Jerry Pournelle
Windows for Workgroups battles LANtastic for domination at Chaos Manor.

222 BOOK AND CD-ROM REVIEWS
Again the Swinging Gates
by Hugh Kenner, Dick Pountain, Jon Udell, and Raymond GA Côté
Another look at Microsoft's leader, a controversial Windows book, how to program in Oberon, and more.

286 STOP BIT
Software Gluttony
by Andy Nicholson
It's time for programmers to rein in today's bloated, resource-hogging applications.

12 EDITORIAL
CD-ROM: Now Is the Time
by Dennis Allen

20 LETTERS
Operating-system trends, OS/2 at a crossroads, digital photography, the ultimate workstation, and other issues.

READER SERVICE

284 Editorial Index by Company
286 Index to Advertisers
288 Index to Advertisers by Product Category

243 BUYER'S GUIDE
Mail Order
Hardware/Software Showcase
Buyer's Mart

PROGRAM LISTINGS
From BIX: Join "listings/frombyte93" and select the appropriate keywords (i.e., "file*").
From the UUNET: ftp to ftp.uu.net, log on as "anonymous," and enter your user ID as your password. Type "cd published/byte" and type "DIR." Files appear in subdirectories arranged by month.

From the BYTE BBS at 1200-9600 bps: Dial (603) 924-9820 and follow the instructions at the prompt.

INSIDE BYTE

BYTE (ISSN 0360-5260) is published monthly with additional issues in April and October by McGraw-Hill, Inc. U.S. subscriber rate $29.95 per year. In Canada and Mexico, $34.95 per year. European surface mail subscriptions $50, airmail $70. Non-European subscriptions, $50 surface mail or $75 airmail. All foreign subscriptions are payable in U.S. funds that can be drawn on a U.S. bank. Single copies $3.50 in the U.S., $4.50 in Canada.

Cover Corner Photography: Ed, Inc., © 1993
First you bought a 40MB hard drive, then an 80MB, stepped up to a 150MB, made the move to a 300MB, and took out a loan to buy a 600MB. It never ends - until today.

Introducing the first line of optical drives that are lightning fast and have unlimited capacity. The PMO-130™ and PMO-650™ are the world’s fastest optical drives with performance that rockets past most magnetic hard drives.
Optical technology has many advantages—removability, reliability, infinite storage capacity, and a lower cost per megabyte over magnetic media. The PMO™ series are based on Pinnacle’s own OHD™ (Optical Hard Drive) technology, making Pinnacle the leader in performance and innovation. There is no higher source in the industry. The PMO-130™ and PMO-650™ are the Twin Peaks. Plug-n-play for PC and compatibles, PS/2, MAC, SUN, HP, DEC, and Silicon Graphics.

It’s more than a hard drive - It’s optical!

(800) 553-7070

Circle 121 on Inquiry Card (RESELLERS: 122).
INSIDE BYTE

BYTE Topic Index

This index helps you find articles that contain information on each of the listed topics. (The topic list changes each month.) Combined with the table of contents (page 4) and the Editorial Index by Company (page 284), you can identify articles by type, subject, title, author, or product discussed.

ACCELERATOR BOARDS 198
ADD-INS 54
AT&T HOBBIT 169
BASIC 207
BUSINESS 213
C++ 231
CD-ROM 116
CHIPS 32, 169
COMMUNICATIONS 146, 159, 169, 177, 178, 209
DBMS 54
DESKTOP 72
DEVELOPMENT 207
FAXES/MODEMS 178, 209, 213
GUI 207
INTERACTIVE TV 139
ITALY 47
MACINTOSH 198, 205, 225
MOBILE COMPUTING 146
MULTIMEDIA 205, 225
NETWORKS 54, 97, 215, 222, 239
OS/2 237
PERIPHERALS 72
PHOTOGRAPHY 20
PORTABLE 146
PRESENTATION GRAPHICS 205
PRINTERS 54
PROGRAMMING 231, 237, 239, 286
QUICKTIME 225
SERVERS 178
SHAREWARE 235
SPREADSHEETS 52
SYSTEMS 41, 54
TCP 215
TEXT 219
TRANSLATION 219
UNIX 239
UTILITIES 235
VIDEO 198
Viruses 97
VOICE 213
WINDOWS 52, 54, 97, 209, 215, 222
WIRELESS 146, 159, 177
WORD PROCESSING 54, 219
WORKSTATIONS 20, 32

GREAT THINGS COME IN SMALL PACKAGES

This powerful print server can tackle your biggest network printing problems

- Connects any parallel printer directly to your Ethernet LAN
- Fully Novell Netware 286 and 386 compatible
- Can attach to 8 file servers simultaneously
- Fast and easy to install
- Combines high-speed printing and exceptional printer control
- Supports encrypted passwords, forms, notify, cancel, and others
- Full one-year warranty and unlimited free technical support
- Made in the U.S.A.

Make the Rose Connection

10850 Wilcrest Drive • Houston, Texas 77099 • Phone (713)933-7673 • Fax (713)933-0044

1-800-333-9343

Circle 130 on Inquiry Card.
The latest addition to our family of winners is the sensational MX17F, whose "sharp image and competitive price make it a compelling choice." So do the MX17F's advanced features. We've combined the latest flat square tube technology with Invar Shadow Mask for distortion-free images and 30% more brightness. Dynamic focus circuitry keeps the whole screen razor-sharp. And non-interlaced resolution — up to 1280 x 1024 — assures the best picture possible. All in all, this microprocessor-based, digitally controlled display is perfect for Windows®. Find out more. Contact us at 1-800-827-3998, or 4392 Corporate Center Drive, Los Alamitos, CA 90720. Tel: 714-827-3998. Fax: 714-827-5522.

©1992 MAG Innovation. All rights reserved. MAG Innovation and its logos are trademarks of MAG Innovation. Windows is a registered trademark of Microsoft Corp. All other brand and product names are trademarks or registered trademarks of their respective owners.

Circle 154 on Inquiry Card (RESELLERS: 155).
Compudyne is the PC manufacturing and direct marketing arm of CompUSA, the Computer SuperStore (NASDAQ symbol: CUSA)—inventors of big volume, deep discounting PC retailing, and the largest chain of computer super stores in the country. Compudyne manufactures top quality, fully-supported computers as available from only the largest PC manufacturers at prices typically found only at garage shop clone houses.

Result? We’re already one of the largest direct PC companies in the country and guarantee that our prices are the lowest of any currently advertised.

Feast your eyes on “one of the best notebook values around” (Mobile Office 7/92), snugly packed into a trim, 5.5 lb package (including battery). All include these nifty features:

- 11" x 8.5" x 1.6" (yes, only 1.6" thick!)
- Full 10" 64 grayscale brilliant VGA screen
- Internal 3 1/2" 1.44 MB floppy drive
- Built-in trackball saves carrying a mouse
- MS/DOS 5.0 and Microsoft® Windows 3.1 installed ready to run
- Lotus® Organizer Personal Information Manager
- Expansion Station
- User-installable FAX modem and other options
- Full keyboard—dedicated ‘page up/down’, ‘home’ and ‘end’ keys
- Built-in serial (2) and parallel (1) ports
- FCC Class B certification
- Built-in BK CPU CACHE
- Lotus® Organizer Personal Information Manager
- FCC Class B certification

“...uses... and wraps a 33 MHz 486DX in a package just over 6 pounds. (This was one) of our favorites.”

December 1992

<table>
<thead>
<tr>
<th>Notebook</th>
<th>CPU</th>
<th>RAM (MBs)</th>
<th>HD (MBs)</th>
<th>Battery Life (Hrs)</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>366SX/25</td>
<td>386 DX-25 MHz, OPTIONAL BX366</td>
<td>2 STANDARD, 4 &amp; 8 OPTIONS</td>
<td>80</td>
<td>3.5</td>
<td>$1,499</td>
</tr>
<tr>
<td>366L/25</td>
<td>INTEL 80386SX-25 MHz, 64K CPU CACHE ADVANCED SL POWER MAN'T.</td>
<td>AS ABOVE</td>
<td>80</td>
<td>3.5</td>
<td>$1,499</td>
</tr>
<tr>
<td>466SX/33</td>
<td>INTEL 80486SX-33 MHz, BUILT-IN BK CPU CACHE</td>
<td>4 STANDARD, 6 &amp; 10 OPTIONS</td>
<td>80</td>
<td>2.5</td>
<td>$1,999</td>
</tr>
<tr>
<td>460DX/33</td>
<td>INTEL 80486DX-33 MHz, BUILT-IN BK CPU CACHE</td>
<td>AS ABOVE</td>
<td>130</td>
<td>2.5</td>
<td>$2,499</td>
</tr>
</tbody>
</table>

ORDERING
- 1-800-932-COMP (2667)
- International callers dial: 1-214-702-0055
- 24 hour fax: 1-214-702-0300
- Corporate credit and volume terms available.

HOURS OF OPERATION
- 7am-10pm (CST) Mon.-Fri. and 9am-5pm (CST) Sat.

WARRANTIES
- 30-day, no questions asked, return policy.
- 1 year limited warranty.

SERVICE & SUPPORT
- Toll-free technical support
- On-site service for desktop and overnight replacement for portables.
- Next-day shipping for most systems.

1-800-932-COMP (2667)

Copyright ©1992 Ziff Communications Company.
Order one of our pre-configured systems or custom-configure your own, choosing from a myriad of options. All systems include...

- Microsoft® Windows 3.1 and MS/DOS 5.0
- Microsoft compatible serial mouse
- 200 watt power supply
- 101 AT-style keyboards
- FCC Class B certification

for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Get Vertical...

For those who prefer the aesthetics and footprint of a desktop tower or need the added drive capacity for file server applications, our mini tower offers an astonishing 6 drive capacity; 4 external plus 1 internal 5.25" and 1 internal 3.5" unit in a mere 8"x16" desktop footprint for only $100 more.

Options, Options, Options...

- Displays: Mono or color VGA; 1024 x 768 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Incl. Grolier's Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- FCC Class B certification

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Get Horizontal...

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Option, Options, Options...

- Displays: Mono or color VGA; 1024 x 768 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Incl. Grolier's Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- FCC Class B certification

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Get Vertical...

For those who prefer the aesthetics and footprint of a desktop tower or need the added drive capacity for file server applications, our mini tower offers an astonishing 6 drive capacity; 4 external plus 1 internal 5.25" and 1 internal 3.5" unit in a mere 8"x16" desktop footprint for only $100 more.

Options, Options, Options...

- Displays: Mono or color VGA; 1024 x 768 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Incl. Grolier's Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- FCC Class B certification

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Get Vertical...

For those who prefer the aesthetics and footprint of a desktop tower or need the added drive capacity for file server applications, our mini tower offers an astonishing 6 drive capacity; 4 external plus 1 internal 5.25" and 1 internal 3.5" unit in a mere 8"x16" desktop footprint for only $100 more.

Options, Options, Options...

- Displays: Mono or color VGA; 1024 x 768 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Incl. Grolier's Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- FCC Class B certification

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.

Get Vertical...

For those who prefer the aesthetics and footprint of a desktop tower or need the added drive capacity for file server applications, our mini tower offers an astonishing 6 drive capacity; 4 external plus 1 internal 5.25" and 1 internal 3.5" unit in a mere 8"x16" desktop footprint for only $100 more.

Options, Options, Options...

- Displays: Mono or color VGA; 1024 x 768 interlaced or non-interlaced; 14" to 20"
- Hard Drives: 40; 80; 120; 211; 483; 680 MBs or 1.2 GBs
- Internal CD-ROM (Incl. Grolier's Encyclopedia, Toolworks, Reference Library and PC-SIG)
- Built in serial (2), parallel (1) and game (1) ports
- Artisoft's LANtastic® LAN
- 8 i/o board slots
- FCC Class B certification

Our standard desktop systems feature aesthetic yet rugged plastic-over-steel construction with "one screw" assembly for quick easy upgrades. They support 3 externally accessible 5.25" drive bays and 2 internal 3.5" units.
EDITORIAL

DENNIS ALLEN

CD-ROM: NOW IS THE TIME

If you don’t have a CD-ROM drive, buy one. For that matter, you ought to buy a CD-ROM drive for every personal computer in your organization, because something big is happening. The ability to create your own CD-ROMs on the desktop is every bit as revolutionary as was the Gutenberg press.

Until now, electronic publishing has been the domain of large organizations that had the dedicated staff to place information onto electronic media. Giant publishing houses have functioned like ancient monasteries, where countless scribes painstakingly penned information onto parchment. No one else had the wherewithal to do it.

Since the debut of CD-ROM, many folks have viewed electronic publishing with a jaundiced eye—a CD-ROM would be great, if only I could get my information on it. Now you can, with the arrival of CD-ROM recorders that sell for less than $8000. In other words, for about the price of an office photocopier, you can have a machine that produces CD-ROMs containing thousands of pages of information.

Think of the reference and archive documents you could place at the fingertips of the people in your organization. Better still, think of the library of CD-ROMs that could contain documents particular to your field and your company. Now think of that library sitting on everyone’s desk for quick and easy access. If you have remote offices, you can send them weekly updates of your structured databases on CD-ROM. Moreover, people who work in the field could use that CD-ROM on their portable computers.

We’re not talking infoglut, either. I’ll bet you can’t find an attorney who wouldn’t like to have a searchable CD-ROM containing all the briefs ever filed by his or her firm. Neither could you find a single, solitary accountant or finance wizard who wouldn’t want a company’s budgets and expense details on a single CD-ROM. You probably know programmers who would give up their subscription to the *Microsoft Systems Journal* for a CD-ROM that had every object and program module ever written by their company’s development staff.

There are as many possibilities as there are megabytes of information. Until now, though, storing that information on a network has been costly, using exotic and expensive jukebox optical systems. Even if you provide the information on the network, remote offices often can’t get to that information.

Also consider the issue of dynamic information versus static. Not all information needs to be updated, and such static information shouldn’t take up expensive writable media space. As for “live” information, not everyone needs update privileges. For these cases, it makes sense to publish on CD-ROM.

The only problem has been that CD-ROM mastering and duplicating costs have been high, especially if you needed only a few copies. Even then, there was no way to build a prototype CD-ROM with your information just to see how usable it might really be.

The advent of CD-ROM recorders for less than $8000 presents wonderfully new opportunities. For such a reasonable amount, and about $40 for the medium (a price that should drop rather quickly), your company can publish CD-ROMs on demand. The real strength of an organization lies in the ability of each individual to leverage the collective knowledge, and CD-ROM publishing is the tool that can allow that process to happen.

There is one catch, though. Most companies have not yet equipped all their systems with CD-ROM drives, and that has to be done. Fortunately, basic drives are available for as little as a couple of hundred dollars. Unfortunately, you will have to make some choices regarding CD-ROM formats, and our cover story this month (“Start the Presses,” page 116) will help you with that.

Falling prices of systems should allow your 1993 budgets to cover that additional cost of CD-ROM drives in every new computer you buy. Keep in mind, too, that once you commit to CD-ROM drives for your company’s internal information, you open the door to vast amounts of CD-ROM-based information from outside sources. In fact, you should expect the selection of CD-ROM material to grow significantly this year.

The point is that CD-ROM has come of age. It is unthinkable to not include CD-ROM in your strategic planning. And to the computer manufacturers who read this column, it is unconscionable to not include CD-ROM drives in new systems.

—Dennis Allen
Editor in Chief
Why it's smarter to go with #1

Now there's an easier-to-use, faster and more powerful dBASE. It's packed with the features you've asked for most, making it smarter than ever to use the world's standard PC database.

Working smarter is faster

With new dBASE IV, you get the job done faster because you work smarter. Smarter because new IQ! optimization technology automatically selects the fastest method to retrieve your data. Smarter because you can create tables, forms, reports, queries and menus in record time—without programming.

Smarter because you get 40 different work areas for easier management of large applications. Plus mouse support for fingertip access to features, an enhanced RUN function to run popular DOS applications from within dBASE, and comprehensive multiuser capabilities. All of which means you maintain tight data integrity, more flexibility and more support than ever before.

Advanced design tools build applications faster

dBASE IV's easy-to-use Control Center comes complete with an innovative set of design tools, including report, form and label generators that help you create your applications quicker. And the Control Center's open architecture makes it easy to enhance or customize your own applications by incorporating any of the third-party add-on products available for dBASE.

Faster applications development

The industry-standard dBASE language comes with a host of improvements that speed development:
- Integrated debugger and a built-in applications generator
- More than 40 new commands, functions and keywords—Template Language now included
- C language-like low-level file I/O
- IBM SAA-compliant SQL
- Advanced BLANK support

Being the standard means world-class support

dBASE has outsold all other databases. With more than three million users and the world's largest community of custom application developers and trainers, dBASE supports your data management needs in ways only the worldwide standard can. Now it's smarter than ever to go with #1.

Get more than $250 in software FREE!

Now with every purchase of dBASE IV v1.5 we're giving away a Protection Pack that includes Central Point Software's Backup and Anti-Virus programs, free (retail value $258). So you get the best database and the best data protection.

See your dealer today. Or call 1-800-331-0877, ext. 6461 for more information.

YES! Send me my free Pro Pack Software!

Check DOS disk size required: [ ] 5 1/4" [ ] 3 1/2"

dBASE IV v1.5 Serial#: ___________________________

Name: _______________________________________

Company: ____________________________________

Address: _____________________________________

City/State/Province: ____________________________

Zip/Postal Code: _______________________________

Phone: _______________________________________

Fax: _________________________________________

COMPLETE this coupon, ATTACH a copy of your sales receipt (or a copy of purchase order and billing invoice) AND ENCLOSE $9.00 U.S. for shipping and handling (check or money order payable to Borland International, Inc.). Send to: Borland's Pro Pack Offer, P.O. Box 7243, San Francisco, California 94120-7243.

Offer good in U.S. and Canada only on dBASE IV v1.5 purchases between June 1 and September 30, 1992. Only original coupons will be accepted. No responsibility is assumed for lost, misdirected or destroyed mail. Please allow 4-6 weeks for delivery. Subject to all local, state and federal regulations. Void where prohibited. Offer not valid for Upgrades, Competitive Upgrades, LAN Packs, Volume Packs, or any other Borland promotion except dBASE IV v1.5 products with Borland's Passport promotion. Distributors and resellers not eligible to participate. Central Point is a registered trademark of Central Point Software.
Everyone's getting into Windows™. And 386-based computers continue to be the popular choice for value-conscious Windows users. The most demanding users—the people who know how to get the most for their money—are insisting on computers built around 40MHz Am386™ microprocessors from AMD.

These are the fastest 386 CPUs made—up to 25% faster in-system than ordinary 386 microprocessors. So they'll run Windows applications the fast and efficient way they were meant to run.

Am386 microprocessors are available in volume. And with AMD's competitive prices, 40MHz 386 machines will come...
Windows Icons Mean?

Create a graphic.

Get the most for the money.

with some mighty attractive price tags.

The Am386DXL and Am386SXL microprocessors are as space-efficient as they are cost-efficient because both are available with PQFP packaging. So holding the line on costs is even easier.

Call 1-800-222-9323 today for more information and ask for Literature Pack 16K.

Because the 40MHz 386 PC is a window of opportunity you can't afford to miss.

Advanced Micro Devices
Microprocessors For The Masses.
SYSTEMPRO™ Compatible 
Upgradeable 
486DX 
256KB/512KB•/1MB•Cache 
32-bit EISA 
Dual-Processor Ready 
4–MB RAM 
$2,495 
Available nationwide at these locations:

INTRODUCING THE ALR PROVEISA

Utilizing ALR's fastest i486DX™ and i486DX2™ CPUs, the ALR PROVEISA™ has the power to breathe through today's most advanced applications. Built-in SuperVGA graphics let Mark view his latest sail designs quickly and clearly, while a 32-bit EISA bus provides the ultimate in PC data throughput.

And wait until you see what this system can do in a networking environment. Utilizing standard IDE drives, the ALR PROVEISA's available MULTUSTM "multi-seek" controller delivers better performance than expensive SCSI subsystems.* Five levels of system security protect valuable network data from tampering. And let's not forget about expandability -- the ALR PROVEISA offers ten EISA expansion slots, twelve drive bays, and room for up to 256-MB of memory.

Of course, the ALR PROVEISA's most unique feature is its upgrade path to dual processing. When you need even more performance, you can simply plug in a second i486 processor. Imagine having the power of two 66-MHz i486DX processors at your fingertips. Now that’s world class speed!

To become a part of the winning ALR tradition, call:

1-800-444-4ALR

Advanced Logic Research, Inc.
9401 Jeronimo Irvine, CA 92718
(714) 581-6770 FAX: (714) 581-9240
ALR Canada Ltd.: 800-465-5979
ALR U.K. Ltd.: 44-635-521922
ALR Deutschland GmbH: 49 69 33 38 11
ALR International (Singapore): 65-742 0866

*Optional larger secondary multiwrite back cache.

Advanced Logic Research, Inc.

Prices and configurations subject to change without notice. Systems shown with optional equipment. Verify exact specifications with ALR. Prices based on U.S. Dollars. ALR is a trademark of Advanced Logic Research. Inc. All other brand and product names are trademarks or registered trademarks of their respective owners. Intel Inside is a trademark of Intel Corp. In order to take full advantage of the ALR MULTUST Controller multiple drives and multitasking operating systems such as Novell NetWare are necessary. © 1992 by Advanced Logic Research, Inc.

Circle 196 on Inquiry Card (RESELLERS: 197).
A highly placed engineer reveals his technical assessment of the new $7,995, 59 MIPS, accelerated graphics, eye-popping SPARCstation LX.
"Can I keep it?"

To more than 650,000 people around the world a Sun workstation on their desk has become a way of life, a must.

Let us present the latest addiction, SPARCstation LX. A graphics workstation that will take you screaming through your applications. Whether you work with CAD, AEC, CASE, design automation or document processing, imaging and office automation, SPARCstation LX is for you.

You can look at the LX in two different ways. Just put on your numbers hat and you'll see 50 MHz, 59 MIPS, 64-bit memory bus, 10Mb/sec I/O, and so forth.

Or just sit down, load your favorite application, and you might not want to leave your desk.

Because the 8-bit accelerated graphics will make you use the full extent of your software, like interactively manipulating 2-D and 3-D wireframe models.

And the built-in ISDN lets you share documents that combine text, graphics, images, audio, and video with anyone, anywhere. All with an intuitive graphical user interface called OPEN LOOK.

You can even create powerful workgroups of SPARCstation LXs and existing PCs with Sun's PC-NFS technology.

Any way you look at it, chances are this remarkable machine will end up staying on your desk. Just call 1-800-426-5321, ext. 520 for more information or a demo. It's worth your time.
Letters

Operating Systems in Depth

Regarding the October 1992 State of the Art section on operating systems, I am slightly confused as to why the authors keep comparing IBM's OS/2 to Microsoft's Windows NT. Windows NT is not aimed at the average computer user but toward high-end servers. OS/2, on the other hand, is aimed at the average user.

Johan Hellman
Stockholm, Sweden

In "OS/2 at the Crossroads" (October 1992), Mark Minasi says OS/2.0 is doing "in a word, badly." Elsewhere in that issue, Steve Mastroianni says, "Interest in OS/2.0 is growing by leaps and bounds" ("OS/2.0 Programming Tools Arrive—Finally"), and "[tool] vendors, noting the overwhelming response to OS/2.0, have announced products or plan to release products...." It's great to see that BYTE permits differing opinions.

Then in the State of the Art Resource Guide, which lists companies that have announced support for OS/2.0, Microsoft is listed. Is this a test to see if we're paying attention?

Bill Zinsmeyer
CompuServe address: 70324.64

Mark Minasi's "OS/2 at the Crossroads" is the first article I've found that accurately reflects the feel and experience of using OS/2.0. Other articles have reflected the authors' newness to OS/2.0's Workplace Shell or have used Windows as the standard by which to judge OS/2.0.

Keep up the reporting on OS/2.

Dave Werner
Hong Kong

In the Resource Guide to the October 1992 State of the Art section on operating-system trends, The Periscope Co., which sells Periscope/32 for OS/2, is incorrectly listed in the Windows NT section. We should be in the OS/2.0 section.

Also, in "OS/2.0 Programming Tools Arrive—Finally," Steve Mastroianni says he doubts that you'll need more debugging tools than the ones IBM provides. The IBM kernel debugger is somewhat useful, but it has no source-level support and very limited symbolic support. In addition, it is hard to use and has a TTY-type serial interface. Periscope/32 for OS/2 supports full-screen source-level and symbolic debugging, and it has a user-friendly interface.

Dan Navarra
Director of Sales and Marketing
The Periscope Co., Inc.
Atlanta, GA

Digital Photography

The article "Smile for the Computer" (November 1992) was informative but missed one important application for digital photography.

I produce training materials, often on technically demanding topics such as advanced manufacturing equipment. Using Digital Vision's ComputerEyes/RT board, along with a standard VHS video signal, I capture images. I import a bit-mapped image into a vector-based illustrating package, such as Micrografx Designer, and use it as a template to overlay a line drawing of the image. I then add text, fills, shading, and gradients as needed and delete the bit map.

This technique allows for the development of very accurate drawings of complicated subject matter quickly and without a tremendous amount of artistic interpretation. It also produces better results on low-end printers than if I used the bit maps directly. And the file sizes of the line drawings are much smaller than the bit maps they replace.

James Barfield
St. Ann, MO

A20 Revisited

Charles Bretana Jr.'s letter "A20 Issues" (November 1992), which responds to Mark J. Minasi's "Exorcising the A20 Poltergeist" (August 1992), contains a substantial error. The 386SX truly has only 24 address lines. Bretana's comment that the 386 extended mode requires access to a 4-GB address space confuses virtual memory with physical memory.

Andrew Klossner
Wilsonville, OR

You're right, but Bretana brings up an interesting point. Unfortunately, my response didn't make it into the November 1992 issue. Briefly, the internal memory registers on the 386 family are 32 bits wide, enabling the 386SL and 386SX to use the 386 protected mode on which Bretana originally commented. However, Intel wanted the 386SL and 386SX to displace the 286, so those chips have only 24 physical address lines. From a hardware point of view, there are 24 address lines: from a software point of view, there are 32.—Mark J. Minasi

The Ultimate Workstation

I was disappointed by your choice of an entry-level Nextstation in "Stalking the Ultimate Workstation" (November 1992). Considering the relative prices of other machines in the test, a Nextstation Turbo Color (with a 33-MHz 68030 CPU, 16 MB of RAM, a 400-MB hard drive, and a 21-inch color display) would have been a more telling comparison. Such a system sells for under $11,000 and would have fared better in the benchmarks.

Ben VonZastrow
Oakland, CA

WE WANT TO HEAR FROM YOU. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, send BIXmail to "editors," or send Internet Mail to letters@bytepb.byte.com. Letters may be edited.
Break 640K *nine* ways with Vermont Views Plus!

Create the ultimate user-interface for your multi-megabyte DOS application—no matter which C compiler and DOS extender you use. Vermont Views Plus now supports *all nine* popular DOS extenders—and we're still counting!

640k barrier shattered!
The 640k barrier is gone at last! And Vermont Views Plus is here to give you the interface power you need to exploit the potential of the huge memory spaces now freely available.

Vermont Views Plus will help you create user-interfaces with the convenience and power of GUI interfaces, but with the speed, compactness and portability possible only with character-based interfaces.

Vermont Views Plus combines a powerful, menu-driven interface designer with a C library of over 600+ functions. You get the convenience of a fourth generation language with the power, flexibility, and blazing execution speed of native C code.

Vermont Views Plus for DOS includes full, documented source code for all libraries.

Put graphics to work
With all the memory available, there is every reason to enhance your text-mode applications with graphic displays. Vermont Views Plus can transparently translate all text-mode menus, forms, and other screen displays into DOS-extended graphics modes. You can easily add charts, graphs, pictures, and other images using one of the popular third-party graphics libraries.

Vermont Views Plus support

<table>
<thead>
<tr>
<th>DOS Extender</th>
<th>286</th>
<th>386/486</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borland C++ 3.1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Watcom C9.0/386</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Intel 386/486 C</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Phar Lap</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Rational Systems</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ergo</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

The ultimate DBMS interface!
Vermont Views Plus is the ultimate interface tool for sophisticated database applications. Use it with any DBMS that has a C-language interface (including Oracle, Informix, Ingres, Sybase, db_VISTA, and c-tree).

You'll find it a snap to create branching data-entry forms with memo fields, scrollable regions, choice lists, and context-sensitive help. Build prototypes almost instantly. Easily extend the prototype into the final application. Slash your total development time!

The universal solution
Any interface you create with Vermont Views can be ported easily among DOS, OS/2, UNIX, POSIX, QNX, and VMS. UNIX versions include encrypted source code, so you can port your applications among machine architectures without further cost. *Never any royalties or runtime fees.*

For MS/PCDOS, Vermont Views Plus is $795; Vermont Views standard edition is $495. For UNIX, POSIX, and VMS, prices start at $1,795 depending on machine class.

For a FREE demo of the ultimate application interface, call 800-848-1248.
The drive and determination to advance can be seen in many forms. Here's a couple we think you'll be excited about.

Some people aspire to become famous athletes. Others to become great scholars. But for a group of us here at Microsoft, there's nothing more important than creating a new line of databases with the tools and technology you need to do your everyday tasks.

For example, some of you will need dBASE™ compatibility and unequaled performance. That's why we have Microsoft FoxPro® 2.5. Some of you need seamless access to data in multiple formats. For you we have the Microsoft Access™ database for Windows™.

But all the tools in the world won't do you much good if you can't get help when you need it. So we have a world-class product support organization to quickly answer all of your database questions.

In addition, we've created a special program for developers that will put you directly in touch with some of our senior product support people.

In the future, our technology will continue to evolve with you in mind. So what you create today will still work tomorrow. In short, there will be no dead ends.

We're also committed to supporting open standards and compatibility. Currently, we are working with ANSI to develop a standard Xbase language.

Plus we fully support the Open Database Connectivity (ODBC) technology, which will allow you to access files from even more of today's database management systems.

And to ensure there will always be a vast supply of industry-specific products and services to meet your database needs, we're forming strong business partnerships with many other companies.

So if you'd like additional information on Microsoft's database solutions, give us a call at (800) 882-2000, Dept. JF6. And find out just how motivated we are to become your database company.
Since the beginning of time, people have been obsessed with reaching ever increasing rates of speed. So what else is new with Microsoft FoxPro 2.5?

Plenty. For starters, the new Microsoft®FoxProâ"¢ 2.5 for Windowsâ"¢ has a rich and productive environment with an intuitive graphical interface. Which means it's never been easier for you to use and develop powerful Xbase applications.

Plus there's a virtual hardware store of tools for both developers and users.

For developers, there are professional tools designed to help you create the most powerful applications possible.

Like the Trace and Debug windows, Project Manager, Menu Builder, Screen Builder and Report Writer.

For users, there are handy tools that make it easy to do complex database tasks without programming. Like Relational Query By Example (RQBE), which allows you to build and see queries instantly. Or the graphical Browse tool, an intuitive way to view data. And finally, Quick Screen and Quick Report, two easy ways to create objects and see data.

And now with the arrival of FoxPro 2.5 for both the Windows and MS-DOS® operating systems (and soon for the Macintosh® and UNIX®), you can have the most powerful and most graphical Xbase applications across all major PC platforms. And if you are thinking about migrating to Windows in the future, have no fear. Because Microsoft FoxPro for Windows will easily run all your FoxPro 2.0 files.

But no matter which platform you choose, you can count on Microsoft FoxPro to provide you with the fastest PC-based database management system.

For additional information, just zip on over to your nearest reseller, or call us at (800) 882-2000, Dept. JF7. We'll be more than happy to tell you all the ways Microsoft FoxPro 2.5 for Windows can get your adrenaline pumping.
People always seek the most direct route to achieve their goals. So you've probably been looking for a database like Microsoft Access.

If you're a database user or programmer, we'd like to show you a great shortcut. It's called Microsoft Access. It's a new database management system for Windows that can give you something no other database can. Easy access to the powerful features you need to do your job.

To start with, Access takes complete advantage of the Microsoft Windows operating system. Which means it has never been easier to create great-looking forms and reports. Plus you can store objects like pictures, graphs, sound, and video. Right in your database files.

And if you ever get stuck, there are ReportWizards, FormWizards and ChartWizards to come to your rescue. They'll ask you questions about format, content and style. Then they'll automatically create your report, form or chart.

There are also Cue Cards to walk you through the most difficult database tasks. Guiding you one step at a time.

In addition, it's easy to create complex queries by using the graphical Query By Example. You just drag and drop tables, join fields, and plug in all of the specifics. And you developers can write sophisticated database applications with Access Basic. A powerful, extensible programming language.

What's more, Microsoft Access can easily read and write all the major database formats directly, including dBASE®, Paradox® and Microsoft SQL Server. So you and your coworkers can still use all your old files, no matter what format they are in. That means, your investment is safe and everyone can easily migrate to Microsoft Access at their own pace.

To receive additional information on Microsoft Access, call (800) 882-2000, Dept. JF8. We'll give it to you straight.
PROTECT YOUR SOFTWARE

NO BUTTON, NO ACCESS.

Dallas Semiconductor is re-shaping the world of software protection and distribution control with a new family of microchips called Buttons. We put the lid on software piracy by packaging microchips in button-shaped, stainless steel cans. The chips contain missing but critical information to make the software run.

We offer a variety of Authorization Buttons and features so you can select the level of protection and price point that are right for you.

<table>
<thead>
<tr>
<th>Security Continuum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button Type</td>
</tr>
<tr>
<td>DS1420 ID Button</td>
</tr>
<tr>
<td>DS1427 Timer Button</td>
</tr>
<tr>
<td>DS1425 Multi Button</td>
</tr>
</tbody>
</table>

Complete Compatibility
Buttons are compatible across all ISA, EISA, and MCA machines — on underpowered notebooks as well as the anti-compatible Brand X’s. We achieve this total compatibility through microchips that are self-powered, unlike other protection devices that must draw power from the host machine.

Snap In, Snap Out
Authorization Buttons interface to the PC’s parallel port via the DS1410 Button Holder. They simply snap in and out. The DS1410 accepts two Buttons concurrently.

The future will be a dongleless world. New computers that accept Buttons directly, including palm and notebook computers, are being designed at OEM’s today.

Made in the U.S.A.
At Dallas Semiconductor, we design and manufacture our own microchips. And we’re the only ones in the software protection business who do. Sixty intricate process steps and a 64-bit unique serial number laserized into each chip prevent duplication.

To learn how to button down your software, give us a call.


dallas semiconductor
4401 South Beltwood Parkway, Dallas, Texas 75244-3292
Telephone: 214-450-8170 FAX: 214-450-3715

FREE!
Authorization Button.
Call 800-258-5061

LETTERS

I am concerned about the absurd comparisons made in your “Stalking the Ultimate Workstation” review. Ben Smith and Raymond GA Côté did a disservice to your readers by comparing the least powerful Next computer to other, much more expensive and fully configured computers. They should have tested the Nextstation Turbo Color or the NeXtimension systems. These are much faster machines, and they would have been less expensive than most of the computers tested.

Eric M. Hall
San Francisco, CA

We received many letters about our “Stalking the Ultimate Workstation” review. Most came from Next enthusiasts whose main criticism was that we didn’t compare a more powerful Nextstation against the higher-performance (and more expensive) workstations from other vendors.

It’s important to note that none of the other machines were fully configured or optimized, either. And performance didn’t always win out. IBM’s RISC System/6000 exceeded in raw performance, but it scored low for its user interface and cost.

It’s impossible to perform a scientific comparison of systems that have different CPUs, operating systems, and user interfaces. The only way to evaluate this spectrum is to call them as we see them, and that’s what we did.

Thanks for your letters.—Ben Smith

FIXES

• In the Ask BYTE section (see “BYTE on UUNET,” November 1992), the address given for FTP access to UUNET is incorrect. The correct address is ftp.uu.net. You should then log on as “anonymous” and use your user ID (i.e., “userid@host”) as your password.
• David Giller’s letter (“Unix for Nothing,” November 1992) on Linux contains the correct FTP address but the wrong case syntax. The FTP address should read nic.funet.fi:/pub/OS/Linux.
• In “Style Meets Substance in Matrox Studio” (November 1992), the price for the Matrox Studio package is incorrectly quoted at $14,000. The correct price is $15,995.
• Compaq’s color notebook computer is incorrectly referenced as the Compaq LITE 386 Lite/25 in “BYTE’s Essential Guide to Portable Computing, 1992.” The correct name is the Compaq LITE/Lite 25C. Also, in the same issue, the text box “Portable Fax Software Rated for DOS and Windows” on page 52 contains a misleading statement about Eclipse Software’s Eclipse Fax. In most cases, Eclipse Fax performs true manual receive. The author was referring to manual receive attempts made through a hotel switchboard when he stated otherwise. For more details on Eclipse Fax, see “Forging a Business Tool: Three Fax Software Packages for Windows” on page 209.
• In “BYTE’s Essential Guide to Windows, 1992,” we incorrectly identified XTree Co.’s product as XTree Gold for Windows. The correct product name is XTree for Windows. The address is 4115 Broad St., Building 1, San Luis Obispo, CA 93401.
Unleash 32-bit Power!

WATCOM C9.0/386 lets you exploit the two key 32-bit performance benefits. The 32-bit flat memory model simplifies memory management and lets applications address beyond the 640K limit. Powerful 32-bit instruction processing delivers a significant speed advantage: typically at least a 2x speedup.

You Get:

- 100% ANSI and SAA compatible compiler and libraries C9.0/386 passes all Plum Hall Validation Suite tests
- Extensive Microsoft compatibility simplifies porting of 16-bit code
- Royalty-free run-time for 32-bit DOS, Windows and OS/2 apps
- Comprehensive toolset includes debugger, linker, profiler and more
- DOS extender support for Rational, Phar Lap and Ergo
- Run-time compatible with WATCOM FORTRAN 77/386

32-bit DOS support includes the DOS/4GW 32-bit DOS extender by Rational Systems with royalty-free runtime license
- Virtual Memory support up to 32Mb

32-bit Windows support enables development and debugging of true 32-bit GUI applications and DLLs.
- Includes licensed Microsoft SDK components

32-bit OS/2 2.0 support includes development for multiple target environments including OS/2 2.0, 32-bit DOS and 32-bit Windows
- Access to full OS/2 2.0 API including Presentation Manager
- Integrated with IBM Workframe/2 Environment

AutoCAD ADS and ADI Development: Everything you need to develop and debug ADS and ADI applications for AutoCAD Release 11

Novell’s Network C for NLM’s SDK includes C/386

The Industry’s Choice.

Autodesk, Robert Wenig, Manager, AutoCAD for Windows: “At Autodesk, we’re using WATCOM C/386 in the development of strategic new products since it gives us a competitive edge through early access to new technologies. We also highly recommend WATCOM C/386 to third party AutoCAD add-on (ADS and ADI) developers.”

Fox Software, David Fulton, President: “FoxPro 2.0 itself is written in WATCOM C, and takes advantage of its many superior features. Optimizing for either speed or compactness is not uncommon, but to accomplish both was quite remarkable.”

GO, Robert Carr, Vice President of Software: “After looking at the 32-bit Intel 80x86 tools available in the industry, WATCOM C was the best choice. Key factors in our decision were performance, functionality, reliability and technical support.”

IBM, John Soyring, Director of OS/2 Software Developer Programs: “IBM and WATCOM are working together closely to integrate these compilers with the OS/2 2.0 Programmer’s Workbench.”

Lotus, David Reed, Chief Scientist and Vice President, Pen-Based Applications: “In new product development we’re working with WATCOM C because of superior code optimization, responsive support, and timely delivery of technologies important to us like p-code and support for GO Corp’s PenPoint.”

Novell, Nancy Woodward, VP and G.M., Development Products: “We searched the industry for the best 386 C compiler technology to incorporate with our developer toolkits. Our choice was WATCOM.”

WATCOM

1-800-265-4555

The Leader in 32-bit Development Tools

415 Phillips Street, Waterloo, Ontario, Canada. Telephone: (519) 886-3705. Fax: (519) 747-4971. *Price does not include freight and taxes where applicable. Authorized dealers may sell for less. WATCOM C and Lightning Device are trademarks of WATCOM International Corp. DOS/4GW and OS/2:16M are the trademarks of Rational Systems Inc. Other trademarks are the properties of their respective owners. Copyright 1992 WATCOM International Corp.

Circle 148 on Inquiry Card.
Texas Instruments comes on strong with the widest selection of powerful 486 notebooks at incredible prices. From 25MHz to the world's most powerful 50MHz notebook in a 5.6-pound package, there's a TI TravelMate just for you.

Take a look at these numbers. You get superior 486 performance with an extraordinary three to five hours of battery life.
Strength numbers.

TravelMate 4000 WinSX/25MHz COLOR
• 4MB RAM std. (20MB max.)
• 120MB HDD
• 6.3 pounds
$3,699 SRP*

TravelMate 4000 WinDX2/40MHz COLOR
• 8MB RAM std. (20MB max.)
• 200MB HDD
• 6.3 pounds
$4,499 SRP*

On our color models, you get 256 simultaneous brilliant colors on a large 9.4" display. All these numbers add up to outstanding performance and value.

There's one more important number. For more information and the dealer nearest you, call 1-800-527-3500.

*Texas Instruments

Circle 141 on Inquiry Card.
Battle of the Workstation Stars

It was a Super Tuesday in November for Unix workstations as three arch rivals—Sun Microsystems, Hewlett-Packard's workstation systems group, and DEC—unveiled several systems built around new high-power CPUs. Sun staked a claim in the low-end workstation turf by unveiling workstations based on the low-priced RISC microSparc microprocessor. HP's workstation systems group based in Chelmsford, Massachusetts, took jabs at DEC, IBM, Silicon Graphics, and Sun with systems based on the single-chip Precision 7100 processor. In addition, DEC introduced the first of its Alpha AXP workstations based on 64-bit RISC technology.

Only Sun's Sparcclassic and Sparcstation LX and DEC's Alpha AXP workstations running Open VMS AXP were shipping in volume as of last December. The other workstations are slated to ship in the first quarter of this year. DEC also plans to...

Portable workstation developer Tadpole Technology (Cambridge, U.K., and Austin, TX) says it will make notebook workstations based on the PowerPC 601 RISC processor being designed by IBM and Motorola. Under terms of an agreement that at press time was contingent on the completion of equity negotiations between the two companies, Tadpole will develop and IBM will market the notebooks.

"Multimedia for business, government, and education is in its adolescence, but for the home, it's very much in its infancy," says Mike Braun, IBM's assistant general manager for multimedia. In Braun's view, the home offers two potential "spaces" of interest: the living room (entertainment) and the den (computers). Commodore's CDTV, Philips' CD-I (Compact Disc Interactive), and Tandy's VIS are "aimed at the living room," Braun says, but "they're not making it, and they won't make it." The reason? "People expect something at least as good as TV or in the price range of Nintendo, but these are in the middle," he explains.

The mainframe as a multimedia server? At Comdex, IBM had an ES-9000 mainframe and showed various full-motion video applications running across network and T1 leased-line connections to Dallas, Texas; Raleigh, North Carolina; and Chicago. IBM also rolled out UltiMotion, its software solution for delivering full-motion video and audio on a computer.
Sound Blaster 16 ASP.
We're not playing games anymore.

Sure, games are great. But with new applications ranging from voice recognition to full-blown integrated multimedia, it's time to get serious about PC audio. With Sound Blaster® 16 ASP™

The 16 ASP comes with all the features you'd expect on a professional-quality sound board, plus more than $500 in bundled software...all for a suggested retail of just under $350.

But the real secret lies in Creative Labs' exclusive Advanced Signal Processing technology: realtime hardware data compression that delivers full CD-quality stereo at a fraction of the CPU power required by other 16-bit boards. And downloadable algorithms that enable future upgrades like voice recognition, time control and special effects.

So if you thought the original Sound Blaster set the standard for games, you're right. But the 16-bit PC Sound Barrier has now been broken. With Sound Blaster 16 ASP: the new Sound Standard for CD-quality PC Audio.

For more information call 1-800-998-LABS.
Low Sun on the Horizon

Sun's two SPARC-compatible workstations and a server cost about the same as high-end 486-based PCs but offer superior performance. All three Sun machines use the new RISC-based microSparc processor (for more details on the microSparc, see "Coming Soon: Sparc Workstations at PC Prices," December 1992 BYTE, page 30). At $4295, the Sparcclassic is (for now, at least) the lowest-priced color workstation available. In quantities of 12, it costs even less: $3995. The Sparcclassic is not a barebones system. It includes 16 MB of RAM (expandable to 96 MB), a 207-MB hard drive, a 15-inch color monitor, a full array of I/O interfaces, and Sun's Solaris 2.1 and the Open Look GUI.

Until Pentium-based machines become available, the Sparcclassic should be capable of outrunning the fastest PCs. Sun says a final production version of the 50-MHz microSparc executes 59 MIPS. A 66-MHz 486DX2 delivers about 54 MIPS. While the microSparc costs only $179 in production quantities, the fastest 486DX chips cost more than $500. Sun hints that faster versions of the microSparc are on the way. Sun's other microSparc workstation is the Sparcstation LX, billed as the lowest-priced ($7995) accelerated graphics computer on the market. The $5295 Sparcstation server is similar to the Sparcclassic, but the server comes with a 1-GB hard drive.

HP Spreads Out

All the new HP systems are based on the company's Precision 7100 processor, which Robert Weinberger, manager of product marketing at HP's workstation systems group, said is "the first implementation of PA-RISC that is fully superscalar, capable of dispatching and executing two instructions per cycle." The 7100 includes an integrated FPU.

At the high end, HP introduced the Model 735 (starts at $34,795) and the Model 755 (starts at $58,995) workstations. Both systems run on the 99-MHz 7100 processor and run HP-UX 9.0. Graphics options range from eight-plane gray-scale (GRX) to 24-plane accelerated, double-buffered color (CRX-482).

At the low end (prices start at $4995; prices for color versions start at $5695), HP announced the Model 715, which uses a 33-MHz version of the 7100; a 50-MHz version is also available ($11,895). HP also announced its desktop Model 725, which runs at 50 MHz and can function as a server due to four EISA slots ($17,895). HP says that, except for the CRX-48Z, all its graphics options will be available up and down the new workstation line so that it can compete head-on with Silicon Graphics.

A New Start for DEC

DEC officials pulled no punches in reiterating that the Alpha rollout was more than a new product announcement. DEC announced two Alpha AXP-based workstations and five servers that will run Open VMS AXP and, when available, DEC's 64-bit OSF/1 for Alpha AXP and Microsoft's Windows NT operating systems. All systems are based on the DECchip 21064 processor. DEC is working to protect its existing customer base by providing native compilers and binary translators for moving Open VMS VAX applications to the Open VMS AXP 1.0 operating system. As applications areas such as multimedia, imaging, and virtual reality move forward, 64-bit addressing will help those applications reach their potential, said Demmer. DEC promises that the 64-bit OSF/1 for Alpha AXP will run applications written to popular Unix variants such as System V, OSF, and Berkeley derivatives.

Heading up the Alpha AXP lineup is the DEC 3000 Model 400 AXP at $14,995. The DEC 3000 Model 500 AXP workstation ($38,995) runs on a 150-MHz processor. On the server side, DEC announced the 133-MHz DEC 3000 Model 400S AXP system ($18,995) and the 150-MHz DEC 3000 Model 500S AXP ($41,195) desktop system. The DEC 4000 Models 610 and 620 AXP distributed/departamental systems are available in single- and dual-processor symmetric multiprocessing configurations. Dual 160-MHz processor configurations provide 247 SPECint/92 performance, DEC says. Single-processor DEC 4000 systems start at $77,000. The DEC 7000 data center is available with up to six 182-MHz processors.

Although system performance is important (see the figure), the success of DEC, HP, and Sun will not be determined solely on the basis of MIPS and SPECmarks. To substantially increase their sales, the companies will have to market their systems as not only fast but also supported by a wide range of applications.

—Dan Muse, Tom Halfhill, and Dave Andrews

NANOBYTES

Cyrix (Richardson, TX) says it plans to bring its second 486 socket-compatible CPU to market by June. The chip is code-named the M7. The Cx486S/2/50, Cyrix's new 486SX compatible, is sampling now and is expected to reach volume availability by March. Targeted at the 486SX market segment—particularly Intel's 33-MHz 486SX—the Cx486S/2/50 runs at 50 MHz internally and 25 MHz externally. Unlike the future M7 chip, which Cyrix says will have an integrated FPU, the Cx486S/2/50 requires a separate FPU module. The Cx486S/2/50 uses an on-board write-back cache, eight write buffers, and burst writes to cut down on CPU bus traffic. Cyrix plans to sell the chip for $249 in quantity, or about $60 more than Intel's 486SX/33.

The latest word from Watcom, which is beta testing a Pentium optimizing compiler, confirms that to get the true performance out of Intel's next-generation chip, you need to optimize code. David Boswell, spokesman for the Waterloo, Ontario-based company, said, "We're beta testing our Pentium compilers with various ISVs [independent software vendors] who have the kind of applications that need a lot of cycles. The results are really encouraging." Boswell said Watcom used its best compiler that's now shipping retail, compiled an application, and ran it on a Pentium-based system. It then used the special Pentium optimizing compiler to run it on the same system. "Compiling the same app, you sure notice a dramatic improvement from those Pentium optimizations," he said.

Microsoft is developing a smart forms-routing program code-named Calvin and Hobbies for Windows for Workgroups, sources said. Sources also said the company is working on a small-business accounting program for Windows, code-named Boris.
Now you don’t have to be a graphic artist or draftsman to create impactful business and technical drawings. Because if you can drag and drop, you can draw. It’s easy with Visio®, Shapeware’s® new drawing program for Microsoft® Windows®3.1 users. By just clicking your mouse, Visio lets you drag and drop shapes, change their size or color, connect them automatically and type in text. Drag. Drop. Done! It’s that easy. Only Visio gives you more than 300 drag and drop SmartShapes® to help you create virtually any drawing or diagram. Unlike clip art, SmartShapes are “intelligent.” They can take on different forms, colors, and proportions and behave the way you expect. And with Visio’s simplified tool set, you can easily create your own customized shapes using a single pencil tool. For easy access, SmartShapes appear right on your screen on job-related “stencils.” Each stencil features all the shapes you could possibly need for your specific drawing.


So if you need to concentrate on what you want to draw, not how to draw it, you need new Visio from Shapeware. The only Windows software that lets you draw from more than your imagination.

**SPECIAL CHARTER OFFER.**

Buy Visio now for just $249. And if you order and register by April 30, 1993, you’ll also receive: ■ An additional Visio stencil set of your choice ■ A free issue of Windows, Windows Sources, and Windows User magazines ■ Free technical phone support for 90 days ■ A 60-day money-back guarantee. To order Visio, or for the names of authorized Visio resellers near you, call toll-free: 1-800-446-3335, ext.EB1
AMD vs. Intel: Back to the Breadboard

After losing a key court decision on its use of Intel microcode in future chip designs, AMD (Sunnyvale, CA) has been forced to delay the introduction of its first 486-compatible microprocessor until June. AMD is developing a version of the Am486 that does not use Intel microcode.

The company suffered the setback in December when a federal judge ruled that a 1976 agreement between the two companies does not allow AMD to use Intel's microcode in its latest chips. The judge's decision dealt a major blow to AMD, which had anticipated a favorable ruling and was planning to introduce the Am486 in January. In fact, AMD was already producing and stockpiling small numbers of the chip, said AMD spokesman David Frink. Those chips will probably be scrapped, unless AMD wins a timely appeal.

Because the "clean room" microcode isn't finished and will require more rigorous compatibility testing, AMD was forced to postpone the introduction.

—Tom Halfhill

Virus Protection from Within

Start-up Rosenthal Engineering ((310) 207-9948) has developed a new technology that it hopes will render current hardware and software antivirus approaches obsolete by protecting executable files from within the files' code. The company plans to market the technology to corporate clients who want to fortify their custom applications and to commercial software developers.

Rosenthal says Virus Armor is deliberately attached to a DOS or Windows application's code as "harden" it against virus attack. When Virus Armor is integrated into program code, it compresses and encrypts the files of a licensee's application. A licensee can harden all the application's files, for maximum protection, or selected files only. The technology will not be marketed directly to end users.

If you run a program hardened with Virus Armor, Virus Armor quickly scans itself, its host application, system memory and boot sector, and accessible floppy disks. If that scan finds a virus, you can scan the entire system to locate the virus and reinstall the infected program from clean master disks. Virus Armor's compression algorithm reduces the size of a hardened application. When Virus Armor detects an attempt to modify its code, it immediately reboots the system.

Virus Armor will eventually support Windows NT, OS/2, and the Mac. One caveat is that Virus Armor is applications-specific software: It only works when you load a hardened application.

—Ed Perratore

SunSelect Intrigues with WABI for Unix

Want to see your unmodified Windows 3.1 shrink-wrapped applications swim around with blazing speed on an X Window System-based Unix box? At Fall Comdex, SunSelect intrigued show goers with its demonstration of Windows applications running fast on a Sun Sparcstation. Such a technology, when released as a product, could mesh nicely with Sun's new high-powered, low-cost color Sparcclassic.

"Basically what we've done is, we've remapped the Windows API to the X Window System," said Tripp Blair, group marketing executive for emulation technologies at SunSelect (Billerica, MA). Blair said SunSelect refers to the technology internally as WABI (Windows Application Binary Interface). Unlike SunPC, SunSelect's program based on Insignia Solutions' emulation technology, WABI does not let you run DOS programs.

"Because Windows applications have to be written to an API, that API starts to separate the software from the hardware," Blair explained. "By implementing a new [WABI] layer, we can take advantage of the underlying hardware on the workstation space and provide very quick performance. We're going to eliminate the performance issue with respect to emulation," he added. When run on a non-Intel platform, however, WABI will still need to occasionally enter DOS emulation mode. Blair estimates that on a RISC platform, WABI is in DOS emulation mode about 15 percent to 40 percent of the time.

According to Blair, the plans are to implement WABI on multiple RISC platforms, as well as the Intel 80x86 platforms. SunSelect isn't saying when WABI will ship as a product.

—Dave Andrews
Our new color printer not only looks great on paper, it looks great on paper.

True, the brilliant color produced by the new Tektronix Phaser® 200 is captivating. But the price is equally attractive. And though we've become the award-winning leader in color printers by frequently outdoing the competition, this time we've even outdone ourselves. Introducing our newest business workgroup color printer.

The Phaser 200 is compatible with virtually any business software and can print two colorful pages per minute. No, not two minutes per page—two pages per minute. And even at a speed like that, it still manages to print eye-catching color on common laser paper or transparencies using a separate input tray for each. You select the medium you want at your computer keyboard. And it switches automatically from user to user just as easily, using its parallel, serial, AppleTalk™, or optional EtherTalk™ and Ethernet™ ports.

It has all the advantages of a laser printer. True Adobe PostScript™ Level 2, networkability, Pantone® colors, speed and price. (Did you notice it's only $3695, slightly below unheard of?) And when you add to that extremely high materials capacity and sparkling TekColor™ output—not just any color, but the indisputably best color in the business—you've got something even better than our previous best. Which is quite a feat.

So stop by your nearest Tektronix dealer or call us at 800/835-6100, Dept. 28J for a free output sample. For faxed information call 503/682-7450, ask for document #1223. You won't find another business investment that looks this good on paper.

Tektronix

Phaser is a trademark of Tektronix, Inc. PostScript is a trademark of Adobe Systems, Inc. All other marks are trademarks or registered trademarks of their respective companies.

Circle 140 on Inquiry Card.
Highly recommended by Rhode Island

Here at ARES we're making friends for life by the way we make, sell, and support our systems. At least that's what we hear from folks who go by names like "Rhode Island Red," "The Duke of Earl," and "Dr. DOOgie" on the second largest users' group on Prodigy, the ARES users' group.

... when I opened up the case of my ARES, I knew this was a breed apart. The care given to detail, with all cables braided and tied down where they wouldn't snag, the dab of paint on the screw heads so they wouldn't loosen by accident, and the dab of sealant on all the connections to hold them secure, all told me that this machine was no assembly line clone. It is quite obvious that ARES builds computers like a precision machine, not just as a piece of merchandise." — Ron Liechty

“My ARES is the fourth or fifth computer that I’ve owned so I can speak from experience. I’ve owned Apples, IBMs and a CompuAdd ... the biggest difference about ARES ... they seem to care more about their users after the purchase than any other company I’ve dealt with.” — Bonnie Williams

<table>
<thead>
<tr>
<th>Feature</th>
<th>ARES</th>
<th>Zen</th>
<th>Gateway</th>
<th>Dell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Year Parts Warranty</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Tech Support 7 Days/24 Hours</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>60 Day Money Back Guarantee</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Limited Lifetime Warranty</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Free On-Site Service First Year</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Remote Diagnostic Service</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>72 Hour Burn-In</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Fix-Up Disk</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Second Year On-Site Service Available</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Free Bulletin Board Service</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Performance Guarantee</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Test All Plug and Play Components</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Custom Packing of Each System</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Certified Documentation of Components</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>ARES 250 Page User's Manual</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Complete Microsoft Documentation</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Software Technical Support Listings</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Custom CMOS Hard Copy</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>4-5 Page Final Text Printed</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Personalized Tech Support Card</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Component Screws Sealed in Place</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Cables Braided and Tied to Case Frame</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Data Cables Silenced to Connection</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>“Smart Fan” for Cooling</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

“I researched seven different mail order companies, narrowed it down to Gateway and ARES and ended up with ARES. I purchased an ARES because they are truly a people company ... and they made me feel that I was the most important customer to them.” — Carol Green

Over the years we have become meticulous about finding the best components to put into every one of our ARES machines. Quantum hard drives. Teac floppy drives. Diamond VL-Bus video cards. And the most powerful, most adaptable motherboard currently available, the new ARES VL-Bus motherboard.

With this ARES VESA (Video Electronics Standard Association) local bus, you can take advantage of these features such as 2.88MB floppy support, fully upgradeable motherboard, two VESA 32Bit Local Bus/ISA slots that support industry standard 32Bit Local Bus cards for video, HD, Ethernet, etc. which will perform up to 10 times faster then EISA, supports onboard RAM of 64MB, a re-programmable FLASH BIOS that protects your investment by allowing future BIOS changes to be installed via floppy disk,
unbreakable metal SIMM sockets that increase board's life expectancy, and two built-in 32Bit Local Bus IDE adapters which support four IDE devices and double the output. Which is how PC Magazine's Small Records Test shows a 240MB Quantum Hard Drive operated at 2.189 MB/sec. on a standard motherboard while our local bus IDE reached an astounding 5.01 MB/sec.

For the best on-screen performance ARES uses the Diamond Viper VLB (32 bit VESA Local Bus video card) which scores 50 million WinMark (Windows Benchmark) and displays 16 million colors.

You can clearly see the component differences shown in the graphs on this page. What these charts can't show is the care with which we put them together under the cover. You'll find that our cabinets are made from sturdy 1.5 mm steel, and coated inside with an FCC-approved reflective finish to minimize interference. We also conduct a 72-hour burn-in and a 4-hour; 100-point quality certification test on your machine and include the test results with your system.

This habit of fussing over our equipment hasn't gone unnoticed over the past ten years. In fact an ARES system was one of only eight chosen as a Top 100 Direct Product in the October 1992 issue of PC Sources. And our fussing doesn't stop after the computer is in your hands.

Our 60-day "No-Questions-Asked" return policy is just one of the ways we stand behind our computers, one of the many "firsts" we've developed to help you feel comfortable with your ARES purchase. Other "firsts" include:

- A two-year warranty on hardware.
- 24-hour/7-days-a-week technical support.
- Two-year, on-site TRW service.
- The first, and still the only company, with a lifetime warranty on service.

So, pick up the phone and call 1-800-322-3200 today. Talk to one of our consultants about the custom configured ARES system that's best for you and your needs. Or, if you like, you can order an instant ARES 486 package, and we'll ship it to you the same day you call.**

Either way we will not charge until your shipment goes out our door (even to APO's), nor will we place a surcharge on your credit card purchase. If you are a business, be sure to ask about our corporate leasing. We also accept purchase orders.

At ARES, we hope you find our fussy style to your liking. For the best components, the most reliable and most durable methods of assembly, right down to our way of doing business with you, we are FUSSY! FUSSY! FUSSY!

Call 1-800-322-3200 today. And we'll ship today.

23660 A Research Dr., Farmington Hills, MI 48335
1-800-322-3200 (313) 473-0808 Fax (313) 473-4450

ARES MICRODEVELOPMENT, INC.

---

**Offer applies to orders placed on Monday through Friday only, during non-holiday periods, for delivery within the continental United States only.
Thumbs Up to New Keyboard Designs

When you face your palms down to use a conventional keyboard, the twisting action, or pronation, puts a lot of stress on your hands, wrists, and forearms. This unnatural position has prompted complaints of RPI (repetitive-motion injuries) and other problems, such as Carpal Tunnel Syndrome. The Bureau of Labor Statistics estimates the cost for a single RPI incident as between $30,000 and $80,000, when you add up all the Workers’ Compensation and other charges. To solve this problem, major companies (e.g., Apple) as well as start-up companies are designing new ergonomic keyboards.

Jeff Spencer (619) 454-0000 and Steve Albert (619) 450-2995 have designed a new type of keyboard that they hope to license to major keyboard manufacturers. They contend that RPI injuries could be eliminated if the Vertical keyboard system (see the photo) were widely adopted.

Apple has also recognized the strains being placed on workers in the information age. You can use Apple’s new Adjustable Keyboard as you would a normal keyboard; however, the Adjustable Keyboard splits into two sections that rotate up to 30 degrees apart. This lets you align your wrists to a more neutral position while typing.

—Gene Smarte and Tom Thompson

OLE 2.0: The Road to Cairo?

Microsoft has released beta versions of the OLE 2.0 specification, which Dave Seres, group program manager at Microsoft’s interoperability group, said offers developers a path to Cairo, the unreleased object-oriented version of Windows. OLE 2.0 should be released in a Windows 16-bit version in March and a Mac version this summer. Seres said OLE 2.0 offers a framework for object-oriented applications development where applications drive each other. OLE 2.0 will act as a common multiplatform macro language by working across Apple’s System 7.0, Windows NT, and 16-bit Windows.

One benefit of OLE 2.0 is in-place object editing. Another feature is link tracking: OLE 2.0 will let you move a subscriber of an object around without it losing its link to the provider.

Features demonstrated in OLE 2.0 have also been shown in a technology called TOOLS (Technology for Object-Oriented Linking and Sharing) from Lotus Development. John Landry, chief technical officer of Lotus, told BYTE that if OLE 2.0 offers features supported in TOOLS, Lotus will support what Microsoft does at the operating-system level.

—Dave Andrews

Apple Stakes Out Color Imaging Market

At the January MacWorld Expo in San Francisco, Apple was expected to announce its first serious entries into the color imaging market. The QuickDraw-based Apple Color Printer, tentatively priced at $2599, is a 360-dpi color ink-jet printer that supports page sizes of up to 11 by 17 inches (European A3 tabloid) at 65 screen lines per inch. Although it doesn’t have a LocalTalk port, the printer is easily shared by multiple Macs: A new printer extension called GrayShare lets other computers on a network direct their output to the printer, which plugs into the SCSI port of any Mac. GrayShare also handles color and grayscale imaging.

The company also planned to announce the Apple Color OneScanner, a single-pass, color flatbed device that supports 24-bit color (16.7 million hues) at resolutions of from 75 to 600 dpi. It comes with Ofo to 2.0, a new color version of the one-button scanning software.

—Tom Thompson and Tom Halfhill

WordPerfect says that in January it will release WordPerfect Works Mac 1.2, a $249 program that is basically the BeagleWorks integrated-software program that WordPerfect bought from San Diego-based Beagle Brothers. After WordPerfect releases version 1.2 of the program, it will concentrate on making the Mac version compatible with WordPerfect Works for DOS and versions of the integrated program for unannounced “other” platforms.

Cyrix has begun an upgrade program for corporations looking to upgrade their 16- and 20-MHz 386DX PCs to 33- and 40-MHz 486-instruction-set-compatible CPUs. Cyrix will sell the $399 Cx486DRII2 to customers who order at least 500 units. Xerox will provide businesswide Cx486DRII2 upgrades through Xerox’s Customer Service Organization (800) 451-4930, ext. 3837.

The latest word on Solaris for the Intel platform is that SunSoft expects to ship the software early in the first quarter of this year. SunSoft has already released preliminary versions of the operating system to selected testers.

Future Domain (Irvine, CA, (714) 253-0400) is now beta testing SCSIWorks, a universal applications interface for DOS and Windows that promises to end the problems of disparate SCSI software interfaces. The product reportedly allows applications drivers written to interfaces such as ASPI (advanced SCSI programming interface), CD-ROM, INT 13 in DOS, and others to work with Future Domain host adapters. As part of an agreement with Corel (Ottawa, Ontario, Canada), the ASPI-to-CAM portion of the program will be included in three SCSI host adapter kits from Future Domain, along with Corel-SCSI, the SCSI integration software that lets you integrate seven peripherals off a single adapter.
First SL notebook.

First Microsoft peer-to-peer notebook.

First upgradable-to-color notebook.

First notebook pre-loaded with network client shells.

We'd also be the first to compare ourselves to our peers. If we had any.
You may be surprised to learn Zenith Data Systems is one of the world's biggest names in SL notebooks. Equally surprising is that we're #1 in the U.S. in SL based portables!!

Maybe we're first in sales because we're first in technology. Zenith Data Systems created the first SL notebook. We're the first peer to peer notebook, first upgradable to color notebook and first with pre-loaded network client shells.

Now being #1 doesn't mean diddily if we don't deliver. But we're satisfying thousands by offering Z-NOTEs of uncompromising quality, with ultra-low Z-DIRECT prices, with unstinting customer assistance and unrivaled Z-CARE service.

So since you're shopping, we invite comparisons. Only Z-NOTE comes with built-in networking with Ethernet-compatible, high-speed communication pipes for LAN connectivity. Only

$1999 Z-DIRECT. No ups, no add-ons no extras.
Z•NOTE is pre-installed with client software for all three leading network systems—Novell, Microsoft and Banyan. Only Z•NOTE could be the first to pre-install Microsoft Windows for Workgroups. Only Z•NOTE could be the first to pre-install Microsoft Windows for Workgroups. Only Z•NOTE could be the first to pre-install Microsoft Windows for Workgroups exclusively uses Intel 386SL microprocessors. The Z•NOTE has an active matrix color display. The Z•NOTE comes with MS-DOS and Microsoft Windows fully loaded and ready to run, right out of the box.

And only Z•NOTE has the low Z•DIRECT price without additional or hidden charges. Those other guys will charge up to $500 on extras to match Z•NOTE features, and you still won't get networking.

Sandy Blagojev, Z•DIRECT Account Executive.
"You can spend up to $500 over quote and still not get networking from those other guys."

So, which will you buy?
A johnny-come-lately notebook from one of them. With none of the above. Or an award-winning Z•NOTE from Z•DIRECT. With all of the above.

"Prices change rapidly. Call for our latest and lowest."
Chances are, what those new lightweight subnotebooks you’re considering are light on are features and functionality. Especially if you use Microsoft Windows. So it's a good thing you’ve discovered new Z•LITE 320L. Because no lightweight does Microsoft Windows like Z•LITE. Z•LITE combines every heavyweight feature you need to run Microsoft Windows in an ultra-lightweight PC. Like the power of Intel 386SL technology—instead of the no-name chip others foist off on you.

The Z•LITE 320L includes our energy-efficient 3.3V design. It’s our newest technology breakthrough, rewarding you with extraordinary battery life and extraordinary features. We even include an “at-a-glance” battery fuel gauge.

Then there’s our full size 8.4” backlit VGA display. Rather than the pint-size unreadable screen you find elsewhere. You’ll enjoy handling our upfront and center, integrated LITEPOINT pointing device. Others offer a tiny control that seems designed for Lilliputians.
So what more can we do for you? Z•LITE 320L gives you flexibility and options. There's two PCMCIA card slots for accommodating high speed data/fax modems, wireless communications and more.

And to make your life easier, we've combined the external floppy disk drive and AC adapter/charger in an all-in-one design.

Z•LITE 320L is the best of Zenith Data Systems technology, with an unbeatable Z•DIRECT price. If lightweight is the way you want to go, Z•LITE 320L is the route to take.

“Z•LITE is light years ahead of the competition!”
Margie Silha, Zenith Data Systems

Network now with Z•DIRECT.
1-800-289-1317
Call Z•DIRECT for the only PCs that come with all these big names: Intel, Conner and Jeffrey Crouch.

At Zenith Data Systems we believe you deserve nothing less than blue chip components. So for our PCs, we offer names like Intel for microprocessors and Conner™ for hard drives.

And for customer assistance, we offer names like Jeffrey Crouch. Now while Jeff may not be top of mind today, one call and you’ll never forget him. Because all our Z•DIRECT customer assistance reps are more than high tech trouble shooters, they’re investment counselors.

They understand Z•NOTEs and Z•STATIONs are designed for integrated connectivity, with an unprecedented ease and breadth of upgradability. It’s what we call investment protection. With so many options for upgrading your investment available on the market today, the good advice of our Customer Assistance Center can be a big help.

Our Customer Assistance Center is ready to answer your questions Mon.-Fri., 7 AM to 11 PM (CST). Call 1-800-CARE-360.

All of which brings us to our renowned Z•CARE service. We think it’s the best in the
business. Because we offer over 400 authorized service centers in North America and more than 2,000 service reps around the world.

With that kind of blanket coverage, you can enjoy on-site service for all our Z•STATIONS the next business day. There's 48-Hour Repair-and-Return or carry-in service for portables. And now Z•CARE offers optional support upgrades including network planning, start up, operation and expansion services. Even the competition finds our service exceptional. Because we're authorized to keep your network operational even if there is a variety of other PC brands or software in place. As for our competitors, they can only send you to "3rd party" service centers. But why go anywhere else when you can come to Z•DIRECT? Get Z series notebooks and PCs you want at a great low Z•DIRECT price—along with unrivaled Z•CARE service. That's what you can expect from the #1 name in SL portable computing!

Z•DIRECT Customer Assistance Center.
Not just troubleshooters, investment counselors.

"Prices change rapidly. Call for our latest and lowest."

Z BEST service is Z•DIRECT.
1-800-289-1317
You can’t go wrong with our Buyer’s Bill of Rights.

Buy Z•DIRECT for investment protection. Z series has unprecedented upgradability, integrated connectivity, ease of use and design. **Right** Buy Z•DIRECT for experienced direct sales consultants. No order takers at Zenith Data Systems. **Right** Buy Z•DIRECT for direct answers. 95% of your problems are solved in one call. **Right** Buy Z•DIRECT for direct technical support and a complete array of direct-to-you peripherals, accessories and software. **Right**

Buy Z•DIRECT for no hassle returns. No questions asked, whatever the reason. Return your PC within 30 days:** Right** Buy Z•DIRECT for direct technical support and a complete array of direct-to-you peripherals, accessories and software. **Right**

*Based on advertised products as configured and availability.

Now call Z•DIRECT 1-800-289-1317

---

**Z•425SX**

"Economical i486 value"

- Intel 25 MHz i486SX
- 4MB RAM user expandable to 40MB
- 170MB hard disk drive with MS-DOS 5.0 and Microsoft Windows 3.1 pre-installed
- Super VGA color monitor, 1024 x 768
- 3.5" 1.44MB internal floppy disk drive
- Mouse
- 5 open 16-bit ISA slots
- One 5.25" accessible drive bay
- One-year limited warranty

**New Lower Price**

$1449

Save $300

**Z•433DX**

"Affordable i486 performance"

- Intel 33 MHz i486DX
- 4MB RAM user expandable to 40MB
- 170MB hard disk drive with MS-DOS 5.0 and Microsoft Windows 3.1 pre-installed
- Super VGA color monitor, 1024 x 768
- 3.5" 1.44MB internal floppy disk drive
- Mouse
- 5 open 16-bit ISA slots
- One 5.25" accessible drive bay
- One-year limited warranty

**New Lower Price**

$1749

Save $300
The Fall Comdex show last November was a combination of good news and bad news. The bad news was the logistical nightmare that occurred when a record crowd of 140,000 converged on Las Vegas. If you were at the show, you had to spend a good deal of time waiting: waiting for a taxi, waiting for a bus, waiting for a room in a hotel.

But the good news far outweighed the bad. Comdex presented us with a record number of interesting new products. For four years now, we have been helping show attendees by highlighting the most interesting products on display—the Best of Comdex. This year, despite the efforts of 16 editors, the assortment of interesting new products made our job the hardest it has ever been.

**Energy Efficiency**

The first category is Best System. This category seems to be dying off of late, being supplanted by Best Portable. But this year we saw a number of impressive new systems.

The winner of the Best System Award is a bold new prototype shown by IBM. The system did not even have a real name yet, being called a "Low-End Energy-Efficient Desktop Prototype," but it is sure to have a huge impact on the industry. It consists of a small system unit (about the size of—a dare I say—an IBM PCjr), a keyboard, and a 10¼-inch active-matrix LCD color monitor. The system unit uses a 3.6-volt IBM version of the 486SX chip. It has four PCMCIA slots and consumes a total of only 30 watts. This low power consumption means it doesn't need a fan and can even be placed inside a desk drawer. Still just a "technology demonstration," this new system may appear as a product in the first half of this year.

The other finalists in the Best System category are both workstations. The DEC Alpha AXP, another prototype due early this year, is the first implementation of a personal computer based on DEC's Alpha chip, a very-high-performance RISC microprocessor.

The other finalist, the Sun Sparcclassic, sports a price tag of $4295 ($3995 in quantities of 12 or more), making it the lowest-priced color workstation on the market. It is the first system to use the new low-cost microSPARC chip developed by Texas Instruments and Sun.

**The Best Gets Better**

In the category of Best Portable, it seems the best just got better. Last year, an Apple Mac PowerBook was deemed the Best Portable. This year, the winner is the new Mac PowerBook Duo systems, which comprise a lightweight notebook, a docking station, and Apple's PowerLatch cableless docking technology (see "New Macs for the Desktop and Road," December 1992 BYTE). On the road, the Duo is a 4¼-pound notebook. On the desktop, the Duo fits into a well-designed docking station that provides access to large displays, networks, expansion slots, and other peripherals.

The other finalists in the Best Portable category are both penpads. The first is the EO Personal Communicator, a $2000 lightweight penpad system that offers sophisticated communications options, including a cellular-phone attachment.

And you can't mention penpads without somehow bringing up Grid—in this case, the Grid Convertible (see "Is It a Penbook or a Notebook?," December 1992 BYTE, page 60). In this penpad, the pen-input screen folds down over a standard keyboard, so you can use either input device as appropriate.

**Fax by Remote**

The Best Peripheral category was dominated by a newcomer, Macroline (San Jose, CA, (408) 453-8088). Its product is the Vomax 2000, an advanced messaging system for the home or office. This device features all the capabilities of a digital answering machine and data/fax modem, yet it uses only a single phone line. The Vomax's remote retrieval feature lets you access both voice and fax messages from remote locations. If you need to be notified immediately, the Vomax can automatically transfer voice and fax messages or alert you via a pager.

Of course, you can't think of peripherals without thinking of monitors. We picked the Nanao Flexscan 15-inch monitor as a finalist in the Best Peripheral category. This

The surprisingly large array of interesting new products at Comdex made it harder than ever to select the best
$899 monitor features a unique automatic power standby mode that qualifies it for the U.S. EPA Energy Star Program (see "A Window to Windows," January BYTE, page 62).

The other finalist is National Semiconductor, with its TyN 2000 fax card. The company's first consumer product combines business audio, data, fax, and voice-mail capabilities with an expandable DSP (digital signal processor), all in a single $279 card (see "A National Voice for the PC," page 67).

Best Printer

There was such a strong selection of printers at the show that we started a new category for them. But that caused another problem: We could not select the single best printer. Thus, we picked two of them: the Hewlett-Packard LaserJet 4 and the IBM Color Jetprinter.

The LaserJet 4 and 4M printers (see "A New LaserJet, A New Standard," December 1992 BYTE) are sure to reinforce HP's leadership position in the laser-printer market. They feature a RISC processor and a 600-dot-per-inch resolution, yet they're aggressively priced at $2199 and $2999.

The $349 5 IBM (Lexmark) Color Jetprinter PS 4079 uses a four-color ink-jet process to produce vibrant colors on coated paper, envelopes, transparencies, and plain paper at sizes of up to 11 by 17 inches. With its simultaneous hot ports and automatic emulation switching, it can fit smoothly into mixed environments.

The remaining finalist in the Best Printer category is the Kyocera Ecosys aSi FS-3500A. This new version of Kyocera's award-winning Ecosys printer uses the same incredibly durable amorphous silicon drum, but it's almost twice as fast, at 18 pages per minute.

Best Software

Despite a surprisingly strong array of new software at the show, selecting the Best Software winner was relatively easy. Microsoft Access (see "Microsoft's Windows Database," December 1992 BYTE) combines the user interface of Visual Basic with a new programming language called Access Basic, making it easy to create powerful database systems. As if that weren't enough, Microsoft gave the product an incredibly low introductory price of $99.

The other finalists in this category are Adobe Photoshop for Windows 2.5 and the interesting Visio from a new company called Shapeware. Photoshop, the preeminent Mac software package, has finally been moved over to Windows and comes complete with all the features of the recently released Mac version.

Visio is a Windows graphics program with a twist; but more about that later.

Best Multimedia Product

The toughest time we had was in the Best Multimedia Product category. Two products stood head and shoulders above the rest, but they had such similar strengths that it was impossible to choose between them. So we ended up naming both Apple QuickTime and Microsoft Video for Windows as winners.

On the Mac, QuickTime is already the standard for viewing digital video, animation, sound, and other dynamic information on your computer screen. With QuickTime 1.5, Apple has added support for Kodak's PhotoCD format, closed-captioned text, and higher-performance software playback. Apple has also released QuickTime for Windows, which lets you play Mac QuickTime movies under Microsoft Windows.

Meanwhile, Microsoft Video for Windows (see "Microsoft's Small-Screen Debut," December 1992 BYTE, page 56) is neither the first nor the only software technology for managing digital video, but it is sure to set the standard for digital video in the fast-growing Windows market. Dozens of developers are already racing to support it, which should result in a new generation of multimedia applications.

The remaining finalist in the multimedia category is Brown-Wagh, with its StudioMagic board. This $495 PC board lets anyone do video editing on a PC.

Best Connectivity Product

Microsoft dominated another category, this time with its Windows for Workgroups (see "Windows for Workgroups," November 1992 BYTE). This product combines peer-to-peer networking functionality with exceptional ease of use. The program features network DDE, which lets applications exchange information across a network.

The other finalists in this category are WordPerfect Office 4.0, and a Lexicom PCMCIA Ethernet card. The new version of WordPerfect Office will combine E-mail with group scheduling and calendaring for DOS, Windows, and Mac platforms. And the $395 Lexicom Credit Card Ethernet Adapter was the most significant and most practical of the many implementations of PCMCIA cards at the show.

Most Significant Technology

In a broad sense, three technologies at Comdex seemed to be almost omnipresent: the PCMCIA cards, local bus, and wireless communications. But several brand-new technologies were on the show floor. Our choice as the Most Significant Technology is Adobe's Acrobat. Acrobat lets you create documents on one type of system and send them to any other, where they can be read or printed with little loss in detail or resolution. Acrobat's foundation is its portable document format, a device-independent file format that can be read on many different types of systems.

The other two finalists in this category are Intel's Indeo and IBM's voice-recognition technology. Indeo is a software product that lets you play video on systems that lack special video hardware. Video quality is automatically adjusted depending on the available hardware. The Indeo technology will be incorporated into Apple QuickTime, Microsoft Video for Windows, and IBM OS/2 environments.

IBM showed three voice-recognition technologies at the show, but its speaker-independent continuous-speech-recognition technology was the best. Developed with Carnegie Mellon University, it lets an IBM RISC System/6000 or a 486DX-based PS/2 recognize speaker-independent continuous speech. The system has a vocabulary of 1000 words at a time, but new vocabularies can be substituted almost instantaneously. A beta version of a developer's kit for this technology is available for a price of $3995.

Best Rookie

The best newcomer to Comdex was Shapeware (Seattle, WA, 206 467-6723), a company founded by former Aldus executives. The Visio software for Windows is a graphics package with a difference. It lets "graphically challenged" businesspeople easily create flowcharts, schematics, and other diagrams using predesigned stencils or templates. (See "Shapeware's Visio Draws a New Path," January BYTE, page 64.)

Best of Show

And finally, we had to choose the Best of the Best, our Best of Show Award. This honor was won easily by Adobe's Acrobat technology. We see this technology as having a far-reaching impact on the world of personal computing. If Acrobat delivers what Adobe says it will, it should touch the lives of every PC user. By helping to cut the wasteful use of paper, it should also help preserve resources, thereby touching the lives of everyone on the planet.

Rich Malloy is BYTE's executive editor based in New York. You can reach him on BIX as "rmalloy."
Introducing Power Windows For Project Managers.

The #1 Rated Project Manager Now Available For Windows.

Power changes people. Especially project managers. They're working smarter and faster with new CA-SuperProject® For Windows. It's the world's most advanced, efficient and reliable project management software — and now it's incredibly easy to use. Total power is yours with just a few mouse clicks. Create and edit projects. Specify resources, task types and durations. Define integrated sub-projects. Build top-down hierarchies and task-dependency relations. Link multiple projects together for cross-project leveling. Perform extensive "what-if" analysis, revising schedules as projects progress. You can bet your career on its advanced and efficient scheduling algorithms.

A recent study of the five leading project managers proved it. Each was assigned the same project, but the finish dates varied by as much as five months. CA-SuperProject For Windows finished first in 214 working days—leaving Microsoft Project, Microsoft Office, Project Workbench and Project Scheduler in the dust.

There's also a wide array of state-of-the-art graphics and detailed reporting tools to help bring your projects to life.

For your free Demo Disk, call 1-800-CALL CAI. Call today. And find out what our power windows can do for you.

CA-SuperProject® For Windows

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11760-7000. All product names referenced herein are trademarks of their respective companies.
IT CAN TURN A ONE-ON-ONE PRESENTATION INTO TELA MM MOBILE MULTIMEDIA
Picture this:
You're giving your client a multimedia presentation. You're showing charts, you're showing graphs, you're showing a full-motion video of your product and you're accompanying all of this with CD-quality stereo sound.

Oh, and you're on the road. Off-site. With nothing but a portable computer.

Presenting Toshiba's latest achievement, the T6400MM Mobile Multimedia System—a road-ready multimedia package that provides all you need to make your next presentation a major media event.

Specifically: the acclaimed Toshiba T6400DXC portable (featuring a 10.4" LCD TFT active matrix color screen), which we've endowed with a pre-installed MediaShare Mambo® DVI card, HSC Interactive and VideoOLE software, Windows® 3.1, a Logitech trackball mouse, and two Altec Lansing speakers.

Of course, if your needs don't extend to multimedia, you can purchase the T6400DXC (or the monochrome T6400DX) separately. With features like a 50MHz i486® DX2 processor, 200MB hard drive, full-length expansion slot and full-function 101-key detachable keyboard, you can practically impress your clients with its spec sheet alone.

To see what we mean, just call us at the toll-free number listed below. We'll direct you to your nearest Toshiba dealer for a presentation of the T6400MM's remarkable abilities.

But be forewarned: there could be quite a crowd surrounding it.

In Touch with Tomorrow
TOSHIBA
1-800-457-7777

© 1993 Toshiba America Information Systems, Inc. The Intel Inside and i486 are trademarks of Intel Corporation. All symbols are trademarked and/or registered by their respective manufacturers.
Connect up to Seven Peripherals!

It's easy! Add all the SCSI devices you need to your system. CorelSCSI makes it simple and inexpensive. CorelSCSI provides you with all the software you need to install and manage all your SCSI devices including: CD-ROM drives, rewritable and WORM optical drives, hard drives, jukeboxes, tape drives, and many more.

Unlimited Flexibility!

CorelSCSI software works with major SCSI host adapters including: Adaptec, Always, BusLogic, D.P.T., and Future Domain. CorelSCSI will allow installation of SCSI devices on DOS, Windows or OS/2 systems. CorelSCSI software will even allow you to setup CD-ROMs, optical drives or jukeboxes on your NetWare* file server!

* Novell Netware 386 v3.x and higher.

Value Packed!

CorelSCSI software includes bonus programs and utilities such as CD-Audio, Corel Tape Backup software, and complete diagnostic tools.*

Quick Installation!

CorelSCSI software is quick and easy to install and will get you up and running immediately. CorelSCSI will ask what devices are connected and install the correct drivers automatically.

If you have CD-ROM drives, tape drives, or any other SCSI devices, you need CorelSCSI!

$99 (US) suggested list price

Compatible host adapter companies:

adaptec
MDPT
Future Domain
BusLogic

Look for the CorelSCSI Approved Product logo.

1-800-836-SCSI
CDN:TEL (613)728-8200 FAX: (613)761-9176
REPORT FROM ITALY

MILAN—Few people know that one of the biggest computer shows in the world, Smau, is held in Italy. Smau was hot, crowded, noisy, and big. In terms of hall space, Smau is larger than Fall Comdex and is second only to the Hannover CeBIT show. For such a big show, it is remarkable how few of the exhibitors are Italian hardware and software manufacturers.

IBM and Olivetti account for about half the sales in the Italian PC market, with the other half split three ways. One-third goes to big U.S. vendors (e.g., AST Research, Tandon, Compaq, and Zenith). Another third consists of large European PC vendors. The final third goes to the no-name box shifters who simply rebadge technology from Taiwan and Hong Kong.

Olidata is an Italian company of some note. It began life in 1982 as an accounting software house developing products for Olivetti systems. In 1986, it broke with Olivetti when it saw an opportunity to import cheap PCs from the Far East.

Olidata, based in Cesena, sells all its machines through dealers. Adolfo Savini, O lidata’s marketing manager, points to the fact that there are some 90,000 dealers in Italy (around 10 times the number in the U.K.). Every village has someone who acts as a dealer. O lidata currently sells only in Italy, but it has plans to enter the U.K. market through a joint venture.

Hantarex is one of the world’s biggest monitor suppliers, making everything from terminal screens to video walls. The monitors are manufactured in Florence and Milan. The Florence factory is a fully automated, robotic production facility making in excess of 1500 monitors a day. The majority of Hantarex’s monitors are sold through OEM channels. Olivetti, IBM, AT&T, and Siemens all use Hantarex monitors. Hantarex also has its own PC brand, called Vegas. It has recently attempted to cut costs by moving its nontechnical production to Hungary, where Hantarex claims the labor is cheaper than in either Hong Kong or Taiwan.

In Italy, U.S. software dominates. DOS, Windows, OS/2, and various flavors of Unix are the only operating systems you see, and all the major application areas are dominated by Lotus, Microsoft, and WordPerfect.

One ray of light is the Baveno-based Italian Software Agency. It produces a Clipper CASE tool that was intended initially just for the Italian market. Its success has led the company to announce an English version. The product is called dBsee (for database software engineering environment), and it generates Clipper code automatically through a neat user interface. The English-language version of dBsee should be available by the time you read this.

The Italians love computers with style but crave innovative products from around the world

Perhaps one reason why there is little Italian software is that nobody seems to buy it. In the U.S., the average number of software licenses sold per PC (excluding the operating system) is between two and three. In Italy, for every three PCs sold, just one software package is sold. The Business Software Association estimates that if software usage is at U.S. levels, developers are losing about 700 billion lire ($700 million) in Italy.

The BSA tries to stop piracy, but the Italian law is not strong enough to make prosecution easy. According to Enzo Mazza of the BSA, the only solution is education. He has launched an "I love original software" campaign, which he believes has had some effect. Cynics however, suggest that it is a problem for all southern Europe, a problem that will be solved only if software is protected.

After a few days in Italy, you realize that what your PC looks like is more important than you’d think. Olivetti, for example, is redesigning its whole range to capture the designer market. In fact, one Olivetti director implied that he didn’t care what I thought about the technical specification of its Quaderno subnotebook—the company was selling it as a fashion accessory, not a tool.

That said, it was with some amusement that I perused the entries in the Smau Best of Show Design Awards. Although Olivetti had a smattering of nominees, most awards went to gadgets designed outside Italy. Although Italians consider style important, they recognize the value of innovation from other countries.

Andy Redfern is BYTE’s former U.K./Europe bureau chief. You can reach him on BIX as "aredfern."
That thunder you hear on the PC prairie is the New Breed Hyundai 486 stampede. The hardest-charging, price-lean, MIPS-mean herd of computers you'll ever see. We're bringing everything from powerful 66MHz 486DX2 machines to Overdrive-Upgradable 486SX-25 computers. And with our 50MHz 486DX2 desktop PC and 486DX-33 blasters, you can handle today's demanding applications.

**Do something “Longhorn” Local Bus.**

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

Your 486 processor was meant to run today's applications. So why rein in all that power? That out-to-pasture, 16-bit VGA card can only deliver 2 Megapixels at best. That's already dated technology. Let her rip with 32-no-blink-bits of “Longhorn” Local Bus video acceleration. And with up to 32 Megapixels standard, believe it, you'll see an incredible difference in Windows performance.

**Do something thunderbolt.**

Lightning-fast “warpspeed” L2 caching is another max-performance feature that's designed into every Hyundai 486. Thunderbolt write-back operations blast your DOS, Windows, or OS/2 data into a box canyon of ultra-fast SRAM. Start out with 128KB standard (more than the cow computers), then expand to 256KB to handle today's big applications. Cache hit for cache hit, the Hyundai 486 Family, with 128KB standard caching, delivers twice the MIPS of non-cached cows.

**Do something upgradable.**

The Hyundai 486 New Breed Family is designed in Silicon Valley, U.S.A., to out-perform the herd.

All of our systems are CPU-upgradable through a single chip via a ZIF or Overdrive socket, so the New Breed lets you double your speed. We won't let tomorrow's 32-bit operating systems blast a hole in your productivity. Just upgrade your Hyundai 486 to any higher-speed Intel 486 CPU in the future.
This Hyundai 486SX-33 can out-muscle those barnyard bovines of cow country. But you be the judge.

Our 32 Megapixel "Longhorn" Local Bus... or a 1 Megapixel moo cow? Our “faster-than-a-blink” Windows accelerator video processing tied to the speed of your 486 CPU... or an old-fashioned bottleneck? Our 1MB VRAM controller producing 1024 x 768 ultra-high, non-interlaced resolution?... or their tired cow VGA? Clearly, the prize goes to the Hyundai New Breed.

Compare our standard 128KB of zero-wait state cache with non-cached cows. And don’t forget, the Hyundai 433S flexes its processing muscle up to 256KB of cache expansion. This system runs at the head of the stampede!

And we don’t just drive the Hyundai stampede, we overdrive it! Double your speed by simply snapping in the Intel Overdrive Processor. And our advanced “warp-speed” L2 cache and "Longhorn" Local Bus graphics engine give your upgraded system the 32-bit video and fast SRAM you’ll need for your higher-speed 486 CPU.

Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we’re fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.

Trouble on the data frontier? Relax. The Hyundai 433S is loaded. A beefy 170MB superfast hard disk, two floppy drives, five external/two internal drive bays, and seven expansion slots mean you won’t go hungry for performance. And dressed up with our 14” flicker-free, non-interlaced, color display, the New Breed 433S is the new king of PC country.

FOR DIRECT SALES
1-800-933-3445

Circle 86 on Inquiry Card (RESELLERS: 87).
We'll give you more than you bargained for. When you go with the 486 stampede, from our 425SP to our powerhouse 466D2TE, we give you exclusive low prices on software. Our size and reputation allow us to forge alliances with all the major players in the industry, which means we can bring you software specials from firms like Microsoft, Borland, Lotus, and Symantec.

Do something safe.

The PC range war can shake everybody's confidence. Except ours. We're a $50 billion global company, which means we have the resources to guarantee outstanding service and support. When you buy New Breed technology, you get New Breed service from a worldwide leader.

In addition to our service and support, we have a TQC (Total Quality Care) program that makes us the double-safe buy. Our 18-month warranty on all systems is a soft ride in the saddle.

The bottom line is your satisfaction. Buy the Hyundai 486 stampede, and you get more than New Breed technology. You get New Breed Service that leaves that old breed behind.

**NEW BREED SERVICE AND SUPPORT**

- One-year, next-business-day, on-site service with all direct orders, followed by 6-month, ship-in warranty on parts and labor.
- 30-day, no-risk, money-back guarantee on anything you buy direct from Hyundai.

- 48-hour turnaround on ship-in repairs.
- Beginners Help Line: 800-933-9917.
- Product spec fax: 800-723-4843.
- 7-days-a-week tech support:
  - 24-hour lifetime tech support: 800-289-4986.
  - 24-hour tech fax: 800-283-4986.
  - 24-hour tech bulletin board: 800-955-5432.
  - Tech support through CompuServe access.

**Hyundai 466D2TE**

New Breed Power Server

- 66MHz: 486DX2 CPU w/8KB integrated cache
- 128KB high-speed L2 cache
- 32-bit EISA architecture
- 8MB RAM standard (expandable to 32MB on system board and 96MB via memory expansion board)
- 32-bit caching SCSI host adapter
- 360MB 12ms SCSI HDD, 256MB disk buffer
- 1.44MB 3-1/2” and 1.2MB 5-1/4” FDDs
- SVGA graphics card
- 14” interlaced, ultra-high resolution, flicker-free, color display with 1024 x 768 resolution, .28 dot pitch, 72MHz refresh rate
- Seven 32-bit EISA slots, one ISA slot
- 5 external and 2 internal drive bays
- 300 watt power supply
- Built-in virus protection, front keylock, 2 level password
- 101 keyboard, 2 button mouse
- MS DOS 5.0 and Windows 3.1

**$3995**

FOR DIRECT SALES 1-800-933-3445
$1799  
**Hyundai 425S**

- 25MHz Intel 486SX w/8MB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB “warped” write-back 20ns 33MHz L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel Overdrive™
- 4MB system memory expandable to 64MB on board
- 80MB 17ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, 28 dot pitch, 72Hz refresh rate, flicker-free, color display
- 1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Other hard drive, video, memory, and monitor options available

$2369  
**Hyundai 433D**

- 33MHz Intel 486DX w/8MB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB “warped” write-back 20ns 33MHz L2 cache (expandable to 256KB)
- Processor upgradable via JIF socket
- 4MB system memory expandable to 64MB on board
- 200MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, 28 dot pitch, 72Hz refresh rate, flicker-free, color display
- 1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Available in floor-standing server model as 4330S1
- Call for price
- Other hard drive, video, memory, and monitor options available

$2599  
**Hyundai 450D2**

- 50MHz Intel 486DX2 w/8MB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB “warped” write-back 20ns 33MHz L2 cache (expandable to 256KB)
- Processor upgradable via JIF socket
- 8MB system memory expandable to 64MB onboard
- 200MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, 28 dot pitch, 72Hz refresh rate, flicker-free, color display
- 1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PC/PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Other hard drive, video, memory, and monitor options available

$2995  
**Hyundai 466D2**

- 66MHz Intel 486DX2 w/8MB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB “warped” write-back 20ns 33MHz L2 cache (expandable to 256KB)
- Processor upgradable via JIF socket
- 8MB system memory expandable to 64MB on board
- 360MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, 28 dot pitch, 72Hz refresh rate, flicker-free, color display
- 1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Available in floor-standing model with ISA architecture as 4660T, call for price
- Other hard drive, video, memory, and monitor options available

DO SOMETHING SMART. CALL HYUNDAI DIRECT SALES.

© 1992 Hyundai Electronics America. All rights reserved.
Two years ago, Lotus Development introduced Improv, a radically different kind of spreadsheet (see “What’s NeXT After 1-2-3?,” October 1990 BYTE). The problem with Improv was that you needed a Next computer to run it—which meant that most of us couldn’t. Now, Lotus has released Improv for Windows. Although it may not lure advanced users away from more traditional spreadsheets—such as Excel, 1-2-3, and Quattro Pro—the results are fascinating, and Improv is sure to influence the future development of the spreadsheet.

Itemizing Your Data
Ordinary spreadsheets organize data into rows and columns. Improv, on the other hand, looks at data as items. Instead of A, B, C and 1, 2, 3, Improv uses item labels, such as “Territory” and “Sales.” Cells that in traditional spreadsheets would have names such as “C3” become “Eastern Region:Q1,” and a typical spreadsheet range such as “A3..A15” becomes the more meaningful “Jan..Dec” in Improv.

To create a formula with Improv, you just point and click on the appropriate items. Improv builds the formula in a formula pane that is attached to the bottom of the worksheet and applies it to all items that are appropriate. (Of course, if you’re a masochist, you can still enter your formulas manually from the keyboard.) While other spreadsheets may let you name cells, ranges, and formulas, the procedure is not set up as an integral part of the structure, as it is with Improv, and is nowhere near as easy.

Screen 1 is a worksheet for a doughnut company, with three categories of items: Region, Year, and Flavor (a subcategory of Region). To see Region as a subcategory of Flavor (so you can tell where plain doughnuts sell best), you just drag and drop the Flavor title (a button in the lower left of the window) in front of the Region title. Improv instantly rearranges the data (see screen 2). Drag the Year title to the upper left of the windows, and Improv places each year on a separate page, which you can flip through by clicking on the page icons. Each of these pages is a view of the underlying model. Improv lets you create as many as 16 different views and then choose among them using a browser window.

Improv formulas are smart (note that the formula for Grand Total of doughnuts sold is smart enough to ignore subtotal Jelly Total), as well as being general-purpose. To create the doughnut spreadsheet using a typical spreadsheet application would require 28 formulas, each existing in a separate cell. Improv uses just three formulas.

A Windows View
In porting Improv to Windows, Lotus adopted the overall Windows look, as well as many of the features that are becoming standard to that environment. For instance, a row of SmartIcons lets you perform common actions at a click of the mouse, and a status bar at the bottom of the window gives you information about the current selection. You can customize the SmartIcons palette, even adding your own icons to which you attach macros to automate repetitive tasks.

If you don’t like the SmartIcons or status bar, you can simply hide them. And a
First Impressions

Click of the right mouse button on a SmartIcon brings up an explanation of that icon. (Elsewhere in Improv, clicking on the right mouse button brings up a menu of actions that are appropriate to that particular object, such as changing the color, font, or justification.)

To create a chart in Improv, you select a worksheet (or range) and click on the Create Chart icon. Improv automatically creates a bar chart (although you can easily change the program so that a different style of chart is created) and lets you add colors and titles and hide elements, as well as many other options. Improv reverses the usual worksheet-chart relationship: Rather than place a chart directly on a worksheet, you add a hotview (essentially a copy of the worksheet) to a chart. Any changes you make to the worksheet are immediately reflected in all charts and hotviews.

Improving Your Old Worksheets

Improv's features make it easy to create new worksheets. But what about worksheets that you've created with other applications?

Improv will import worksheets from Lotus 1-2-3 (including the new release 3.4), Excel, and a variety of other formats, and you can tell it to use the row and column labels as item names. As Improv imports a spreadsheet, it filters cells that contain formulas and converts them to Improv formulas. Also, Improv alerts you if any of the formulas didn't make the trip successfully.

Unfortunately, due to the difference in the way a traditional spreadsheet organizes data, you may have to do a fair bit of massaging to get your Improv worksheet to look right. And if you need to import a 3-D spreadsheet, things get even trickier. In my tests with a beta version of Improv, I was able to import some (but not all) of the Excel worksheets I tried, and formulas containing references to other worksheets were lost.

Improv maintains multiple spreadsheets as pages of a single worksheet or as several worksheets in a single model. You can link worksheets in a model by pointing and clicking to create intersheet formulas. To link worksheets not in the same model—or those in other applications—you must use DDE or OLE links.

Aside from the issue of importing data, Improv has just a few interface quirks, such as the lack of a button to automatically resize columns to fit cell contents. Nor can you add blank lines to a worksheet for appearance's sake. And while Improv can automatically assign label names (e.g., duplicate an item called "Jan," and Improv will automatically label the next items "Feb," "Mar," and so on), this feature doesn't work as well as Excel's auto-fill feature: Create the labels 1, 3, and 5, and Improv will label the next item 6, unless you explicitly spell out the steps in a Data Fill dialog box.

A New Species of Spreadsheet

The development of the spreadsheet is surely a case of punctuated evolution: gradual improvements marked by occasional dramatic changes. Just as VisiCalc was overwhelmed by the speed and charting abilities of Lotus 1-2-3, 1-2-3 has lately been challenged by spreadsheet programs better adapted to the world of graphical interfaces.

In spite of a few minor quirks, Improv is a major advance in the spreadsheet metaphor. It is probably the easiest spreadsheet for novices to learn, and even old hands may find the traditional spreadsheets they're used to working with to be inflexible and hidebound once they've played with Improv. Now that Improv has migrated to the Windows world, the effect on the rest of the spreadsheet community should be very interesting.

Kenneth M. Sheldon is a consulting editor for BYTE specializing in new computer technologies. You can reach him on BIX as "ksheldon."

The Facts

Improv for Windows

$495

System requirements:
A 386SX or higher with VGA, a mouse, DOS 3.31 or higher, Windows 3.1, 4 MB of RAM, and a hard disk with up to 12 MB of free space.

Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(800) 343-5414
(617) 577-8500
fax: (617) 693-1197
Circle 1167 on Inquiry Card.
FoxPro 2.5 for DOS and Windows

Like many FoxPro users, I rejoiced in the speed and power of the blockbuster version 2.0. I worked hard to develop a multituser FoxPro application that would enable BYTE's DOS, Windows, Mac, and Unix users to share data on our LAN. Clearly, I should have paid more respect to Murphy's Law. The challenge of merging three code bases into a common core made the vision of multiplatform FoxPro painfully slow to materialize. The simultaneous release of FoxPro 2.5 for DOS and for Windows represents two giant steps in the right direction.

Both are high-performance multituser products that can share not only common data, but also common FoxPro application code.

My first test of FoxPro for Windows was, of course, to rebuild and run my biggest version 2.0 application. It worked, but what appeared in the upper-left quadrant of my 1024- by 768-pixel Windows display were ugly caricatures of my carefully designed FoxPro 2.0 screens. By default, FoxPro for Windows presents DOS-defined screens using a monospace OEM font, squashed controls, and lines and boxes made from characters rather than Windows graphics.

To perform a Windows face-lift, you edit the screen's underlying database (its .SCX file) using the FoxPro for Windows screen builder. It spawns a tool called the transporter, which automatically duplicates each screen-definition record, tags one member of each pair for DOS and the other for Windows, and assigns default fonts, sizes, and positions to the Windows elements. When you generate code from that screen database, you're actually creating two similar programs wrapped up in a giant case statement. At run time, one of those branches will execute depending on whether the system variable _DOS or _WINDOWS is true.

While the automatic treatment yields true Windows screens, I had to fiddle a lot with color, size, style, and placement to make my screens look good. I'd rather not repeat the exercise for the Mac and then for Unix. A more intelligent transporter could simplify that chore. Even then, there would be another wrinkle. Automatic bracketing of code for multiple platforms requires use of the screen builder and code generator. I use these tools for all static interface elements, but I've tended to hand-code dynamic elements such as pop-up menus. Now I'll have to test for _DOS or _WINDOWS (or, soon, _MAC or _UNIX) in each of these cases and code variations for each platform. I'd hoped to avoid that. If DOS is my reference platform, I shouldn't need to make exceptions for Windows.

Conversion hassles aside, there's a lot to like about FoxPro for Windows. A 32-bit application built on Watcom's Windows extender, it runs single-table queries briskly and blows away version 2.0 on multitabular queries. There are plenty of Windows goodies as well. The new GENERAL data type holds sounds, pictures, and other objects that are dished up by OLE servers.

FoxPro's DDE support is spiffy. I was delighted by how easily I made FoxPro play the role of a DDE server that could receive SQL queries from DDE clients, execute the queries, and poke back results. Other Windows enhancements include odometer-like "spinner" controls, functions that call the Windows common font and file dialog boxes, and the ability to drag and drop lines in the text editor. The beta version I tested wasn't able to call DLLs from FoxPro code or use ODBC (Open Database Connectivity) to fetch foreign data—two features Microsoft says will appear in the shipping product.

If it weren't for all the new toys in FoxPro for Windows, I'd be tempted to stick with its DOS counterpart. Like version 2.0, it comes in 16- and 32-bit versions. The latter, which is now built on Phar Lap's DPMI (DOS Protected Mode Interface)-compliant DOS extender, coexists with the DOS 5.0 and Windows 3.x memory managers and is also screamingly fast. I won't benchmark formally until both version 2.5 products ship, but it looks like the 32-bit DOS product will leave the 32-bit Windows product in the dust. Because it can now also run under Windows, the DOS product merits serious consideration even in Windows-centric environments. What you gain with the DOS version is speed and freedom from multiple-platform maintenance. What you lose, though, is the ability to stir the spicy FoxPro ingredient into a rich stew of Windows applications.

How does FoxPro for Windows compare to Access? It depends. If I had to target only Windows, I'd go with Access, which is smoother than FoxPro's initial Windows port. Access's intrinsic SQL is also more appealing than FoxPro's layered, read-only SQL. I'd favor FoxPro for raw speed, however, particularly with huge databases. And, of course, I still hope to deliver my FoxPro application to Mac and Unix users. FoxPro's multplatform strategy isn't as refined as I'd like, but it looks workable. Murphy willing, I'll find out for sure later this year.

—Jon Udell

THE FACTS

FoxPro 2.5 for Windows
FoxPro 2.5 for DOS
$495 each

System requirements:
Hardware (DOS): A 286 for the 16-bit version; a 386 with 2 MB of RAM for the 32-bit version.
Hardware (Windows): A 386 with 4 to 6 MB of RAM.
Software: DOS 3.1 or higher; Windows 3.0 or higher.

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
fax: (206) 936-7329

Circle 1169 on Inquiry Card.
Powerful New Tools for OS/2 Programming

The WorkFrame/2 product ... because the best environment for application development is the one you create yourself.

With WorkFrame/2, you can integrate your choice of development tools – including those for DOS and Windows. It's open, configurable and language independent. And it's easy to customize the WorkFrame/2 interface to create your own development environment.

The concept is simple. WorkFrame/2 organizes files into logical units called projects. By associating each project with your personal choice of compiler/debugger/linker/editor you can get the greatest productivity possible from all your development tools.

The C Set/2 product ... because application development should be fast – and simple!

C Set/2 delivers a one-two punch to help you create some of the fastest-performing OS/2-based applications possible.

First, the 32-bit C compiler enables your applications to exploit the speed and power of 386- and 486-based computers. It's the best high-performance code optimizer in the business. With the C Set/2 compiler, unsafe optimizations simply don't exist.

Second, C Set/2 comes with a fully interactive, full-function, source-level 32-bit Presentation Manager debugger. Just point your mouse and shoot, using the graphical PM user interface – or use the keyboard.

Either way it's easy. And you'll get instant feedback on the screen to verify what you're doing. Debugging has never been so simple!

And there's more. The C Set/2 compiler conforms to industry standards – including ANSI C and ISO/IEC – and offers Microsoft C compatibility. With features like a full suite of runtime libraries and 32-16 bit linkage, you can be sure C Set/2 will provide the function and flexibility you need to make application development fast and simple – the way it should be.

OS/2 2.0 Developer's Toolkit ... because it takes the right set of tools to build powerful applications.

OS/2 2.0 Developer's Toolkit is the perfect companion to use with C Set/2. It contains a variety of language-independent application build and productivity tools. For the C Set/2 compiler, Toolkit provides the system linker and system header files. It also contains the import libraries and the NMAKE utility you need to dramatically increase the capabilities of C Set/2 to build powerful applications.

To order or get more information on how IBM application development tools can work in your OS/2 environment,

in the USA call 1-800-342-6672
in Canada call 1-800-465-7999

Making good things happen in application development...
SuperMatch, the part of SuperMac Technology that creates products for PCs, has done itself proud. Its latest product, VideoSpigot for Windows, brings to Windows users the image quality and ease of installation that its Mac predecessor carries. Built to run with Microsoft’s Video for Windows, the video-capture and playback extensions for Windows 3.1, this newest VideoSpigot offers some key advantages that other video-capture boards don’t have.

VideoSpigot for Windows is a single board with no jumpers or DIP switches. It occupies one interrupt—being a 16-bit board, it can be placed above IRQ (interrupt request) 7—and one 8-KB region of memory. That 8-KB relocatable buffer became a favorite of mine from the very beginning. When I looked at the beta version of Video for Windows (see “Microsoft’s Small-Screen Debut,” December 1992 BYTE, page 56), I was stymied by the inability of the capture boards that are supported by that release (including Video Blaster and Super Video Windows) to run in my system with 16 MB of memory installed. I had to get one of the PCs from BYTE’s Multimedia Lab, a Uniq 486/50, downsize to 8 MB to accommodate the overlay boards.

Now I can get the Uniq system decked out again, because VideoSpigot’s memory buffer can be located either below the 1-MB mark or in upper memory around the 15- to 16-MB area (which is where overlap boards typically go). VideoSpigot’s installation dialog box has a “Scan” button that will hunt for a free 8-KB hunk of memory. Even though it failed to find any such free memory on my system, it worked fine when I gave it a handpicked address to search for.

Unlike most other current Windows digitizers, this board is not a video-overlay board. Its only lot in life is digitizing, and that’s a plus. Because this board doesn’t expect to be cabled to a VGA adapter’s feature connector (as video-overlay boards do), you can use VideoSpigot with any kind of display you like. Overlay boards often get cranky in Super VGA modes, and they can get really cranky (read that as “stop working”) at high resolutions. You can run an overlay board without its VGA connection, but the video often comes in misaligned because the VGA mode you’re using can’t be sensed. In contrast, VideoSpigot doesn’t care what display you’re using—just as long as you’re using a Windows-compatible display board, you’re in business.

Aside from all this, VideoSpigot’s key advantage is the quality of its capture. The board uses extremely high quality digital-encoding hardware. SuperMac claims VideoSpigot will capture 30 frames per second at the standard 160- by 120-pixel window size and 15 frames per second at the 320- by 240-pixel window size. While I verified that it did indeed move faster than my Video Blaster, it was difficult to get a reliable measurement because of all the conditions that affect capture speed (disk fragmentation, disk cache, and memory are key variables).

When it comes to playback time, the board steps out of the way; there is no hardware acceleration of either the display or decompression. SuperMac has its own compressor/decompressor software that it claims does the standard set provided by Microsoft one better. This software plugs in as a Windows driver and offers higher compression ratios. In addition, according to SuperMac, it also offers better-looking video.

As with other Windows capture boards, the audio that accompanies your video is digitized through a separate connection to an MPC-compatible sound card. VideoSpigot connects to both composite and S-Video (Y/C) video devices through ports on the back of the card. Only one input is active at a time, and the capture driver lets you select an input manually or else senses which connection has an active signal and selects it for you.

VideoSpigot will be bundled with a collection of software from Asymetrix, including Multimedia ToolBook, Make Your Point, and MediaBlitz. A video editor isn’t part of the bundle because a third-party editor (à la Adobe Premiere for the Mac) for Windows doesn’t exist yet; Video for Windows does include some limited editing capabilities. VideoSpigot’s ease of installation and use, relatively low cost, high-quality color, and enhanced compression software make it as obvious a choice for Windows users as it has been for Mac users.

—Tom Yager

THE FACTS

VideoSpigot for Windows
$499

SuperMac Technology
485 Potrero Ave.
Sunnyvale, CA 94086
(408) 245-2202
fax: (408) 735-7250
Circle 1168 on Inquiry Card.
BallPoint® mouse raises your comfort level several degrees. And its easy-to-see cursor lowers your frustration level just as much. The point being, if you use the Windows® operating system on a laptop, BallPoint makes your work even easier. So call us at (800) 426-9400 to find out how to get one. Because next to this mouse, others are hard to handle.
Atari's Falcon030 Leads the Pack

While IBM, Apple, and others are expected to introduce computers with DSPs (digital signal processors) later this year, the first company to ship a low-cost PC with a DSP is none other than Atari—the video-game company that once hit $2 billion a year in sales and then nearly collapsed in the mid-1980s.

Although Atari is smaller these days, it's still selling a line of computers. Atari's latest computer, the Falcon030, is a surprisingly versatile machine that points the way toward a new generation of multimedia computers. Given Atari's track record, it's hard not to be skeptical, but the Falcon really is something different.

Right out of the box, with no additional hardware required, you can attach the Falcon to a VGA monitor, a TV, a VCR, a camcorder, a stereo system, a pair of microphones, an electric guitar, a MIDI keyboard, or almost any audio/video device that accepts a patch cord. To add similar capabilities to any other PC would probably cost more than the price of the Falcon—$799 for the basic unit with 1 MB of RAM and a 1.44-MB floppy drive.

With the right software, you can mix multiple sound sources, apply special effects, and record audio on either a tape recorder or the computer's hard disk. If you choose direct-to-disk digital recording, the Falcon supports eight-track, 16-bit stereo at sampling rates of up to 50 kHz, exceeding the quality of CDs and DAT (digital audiotape).

The Falcon is also adept at handling video and graphics. Built-in video supports 65,536 colors at 640 by 480 pixels, with 262,144 possible hues. The computer accepts an external video synchronization signal for genlocking, and a special overlay mode lets you add titling and special effects. Composite video and RF outputs are standard. It wouldn't take much to turn the Falcon into a low-cost video workstation.

What makes all this possible is the 32-MHz Motorola 68001 DSP, coupled to a 16-MHz 68030 CPU and a pair of custom coprocessors. The DSP is the most important component. DSPs excel at processing fast streams of sampled analog data in real time, making them ideal for multimedia applications. Computers with DSPs can do a better job of manipulating music and speech, compressing sound and graphics, and communicating with analog devices. What's more, DSPs can work in the background, freeing the CPU for other tasks.

For example, the Falcon's DSP supports eight 16-bit DMA channels that operate in parallel, allowing simultaneous audio recording and playback. Standard audio interfaces include stereo I/O jacks and a pair of MIDI ports for attaching music keyboards and other MIDI devices.

Another port brings out the pins of the DSP bus. This makes the DSP accessible for a wide range of uses, including video digitizers and telecommunications. Also standard are a LocalTalk port for easy networking with Macs and a SCSI-2 port with DMA. The fast SCSI port is vital because the Falcon's internal 65-MB hard drive isn't nearly large enough for serious digital recording, which at CD quality gobbles up more than 7 MB per minute. With the SCSI-2 port, you can add as much storage as you can afford.

The Falcon runs a proprietary multitasking operating system and Digital Research's GEM. It's compatible with most software written for Atari's earlier ST computers, including a wide variety of applications for business, desktop publishing, and entertainment. There's a particular abundance of music software, and some of it's being rewritten to take advantage of the Falcon's DSP. Only a few DSP-driven programs were available for this evaluation, however, and they were still unfinished.

One program I tested was Musicom. I plugged an electric guitar into the Falcon and used Musicom to add flanging, harmonizing, equalizing, digital delay, and heavy-metal distortion—replacing hundreds of dollars' worth of special-effects pedals. Next, I digitally recorded a rhythm track onto the Falcon's hard disk. I used Musicom to play back the rhythm guitar, mix in a lead guitar, and record both parts on a tape recorder. And I did all this without any extra hardware.

Until now, the only desktop computers with integrated DSPs were the Next workstations, which also use the 56001 DSP from Motorola. IBM and Texas Instruments have developed a DSP called the MWave, which will appear in IBM's UltraSparc computers later this year. Apple has adopted AT&T's DSP3210 for its future Macs. With the Falcon030, Atari is offering a tantalizing and affordable preview of things to come.

—Tom R. Halfhill

THE FACTS

Falcon030
with 1 MB of RAM and a 1.44-MB floppy drive, $799; with 4 MB of RAM (expandable to 14 MB) and an internal 65-MB IDE hard drive, $1299

Atari
1196 Borregas Ave.
Sunnyvale, CA 94089
(408) 745-7000
fax: (408) 745-4306
Circle 1170 on Inquiry Card.
WATCOM SQL Developer’s Edition
by WATCOM
Complete client/server development tool allows you to develop and deploy single-user standalone applications, and to develop applications for use with the Network Server Edition (sold separately). Includes: Single-user database server (both 16 and 32-bit versions); ACME application development system; Embedded SQL C/C++ preprocessor; SQL libraries for WATCOM C, C/386, MS/C++ and BC/C++.

List: $395 Ours: $299

Essential Graphics Chart™ for Windows by South Mountain Software
Essential Graphics Chart for Windows lets you turn your data into charts and graphs that make an immediate visual impact. Features include: DLL: works with any Windows API compatible language, 2D bar, 3D bar, legends for all chart types, real-time charts, true perspective and rotational capability. No Royalties.

List: $399 Ours: $299

CA-Clipper 5.2 by Computer Associates
Clipper is a comprehensive PC application development system for PCs offering network support, user extensibility, a replaceable database driver and executable file generation. An open architecture system. Clipper includes a robust language, pre-processor, compiler, linker, virtual memory manager, editor and debugger, and permits development of applications that are larger than available memory.

List: $795 Ours: $499

Microsoft Windows for Workgroups by Microsoft Corporation
Considering how much easier one PC is to use with the MS Windows™ operating system, imagine what MS Windows™ for Workgroups can do for an entire group. Such as information sharing among many PC users that can lead to even better, more collaborative work. Printer sharing that uses hardware resources more efficiently. And schedule management that improves efficiency.

Workgroups List: $249 Ours: $149
ADD-On List: $ 79 Ours: $ 61

INSTANT REPLAY PRO (IRPRO) 3.0 by Instant Replay Corp.
IRPRO is an authoring/development software system for the creation of: 1) Demo disks and software ads. 2) tutorials, training materials, CBT, 3) professional presentations: a) Laserdisks based, and b) computer managed slide shows. IRPRO manages the capture of audio, video, graphics, animations and compressed video for incorporation into your presentation.

List: $795 Ours: $599

Q+E Database Library (QELIB) 1.1 by Pioneer Software
A set of Dynamic Link Libraries providing a common call level interface for developer tools such as Visual BASIC, ToolBook, Actor, Smalltalk, C++, etc and most macro language products to access data from Oracle, SQL Server, Sybase, EE Database Manager, DB2, Network SQL, dBASE, Paradox. Excel, and Text files.

List: $399 Ours: $359

DESQview/X by Quarterdeck
Graphics, Multitasking, and Connectivity. DESQview/X is a stunning DOS graphic environment—just like MS Windows or OS/2. Run multiple programs at the same time using simple, intuitive icons, with an added benefit: The X-Windows, the international standard for graphical computing and distributed computing. This means DESQview/X can run programs remotely from other DOS PC’s running DESQview/X, or UNIX X-Windows workstations, with point and click simplicity. Your networked resources can become transparently accessible from your PC. Also includes QEMM-386, Manifold, full compatibility with MS Windows, and the Adobe Type Manager. Call for details.

List: $275 Ours: $248

FAX center # 0027-3001
WATCOM C/386 9.0 by WATCOM
Develop and Debug 32-bit applications for extended DOS, Windows, and OS/2 2.0 with the most complete 32-bit C development package available. Includes the royalty-free DOS/4GW DOS extender by Rational Systems, components from MS Windows SDK, compiler, linker, debugger, profiler, plus numerous development tools. Supports other industry standard 32-bit DOS extenders. Create ADS Applications for AutoCAD or embedded systems development.

List: $895  Ours: $599
FAX: 1683-0001

WindowsMAKER Professional 4.0 by Blue Sky Software
Next generation of industry standard C/C++ development tool for Windows. The easiest fastest way to create Windows apps, just point and click. New architecture uses Switch-it™ Code Generation Modules for generating ANSI C, MFC++, or OWL C++ code among others. Award-winning Visual Prototype lets you test the look & feel and make changes on the fly. TrueCode technology ensures the user code is preserved during code regeneration. Generates Windows .EXE w/fully commented C or C++ source. CUA & SAA compliant.

List: $995  Ours: $695
FAX: 2602-0003

ED-The Programmer’s Editor by Lifeboat Software
A full-featured windows based programmer’s editor is here! ED is setting the standard with features like background compilation, automatic code indenting and completion, hyper-text function/procedure lookups, “smart” language-specific editing, a fast “C” extension language, Windows Toolbar, unlimited undo and redo, keyboard macros and remapping, and emulation of popular DOS editors (BRIEF, Wordstar, Qedit, Norton).

List: $299  Ours: $199
FAX: 0233-0011

Microsoft Visual Basic for DOS by Microsoft Corporation
Award-Winning productivity—now available for DOS! Draw forms and controls, write event-procedures, use and create custom controls-in DOS! Create all-new apps or combine with existing C/C++ or Pascal code. Highly compatible with VB/Win for multi-platform development. Even run existing MS Quick Basic/Basic-PDS code! Includes a native 80 x 86 compiler that creates 100% stand-alone .EXE files, 386 code generation, MOVE overlays, an integrated ISAM and much more!

Standard Edition  List: $199  Ours: $139
Professional Edition  List: $495  Ours: $325
FAX: 1269-0039

Lahey F77L-EM/32 by Lahey Computer Systems
Industry leading 32-bit FORTRAN Language System includes Phar Lap’s 386/DOS Extender, VCPI, XMS, and DPMI compliant extender enables users to access up to 4GB and operate in the OS/2 and MS Windows DOS box. The extender is royalty-free and includes virtual memory support. 5.1 includes Editor, profiler, make utility, library manager, video graphics and 466 optimizations. 90 new features including support for popular VAX and IBM VS.

List: $1390  Ours: $1015
FAX: 1476-0004

DataBoss 3.5 by Kedwell Software, Inc.
Relational database application generator. Use to develop complete applications with menus, forms, browse tables, memo fields, reports and more. Includes sophisticated screen painter; field definition template for defining field characteristics, indexes, data files and their relations; WYSIWYG report designer; generator engine and skeletal files. Generates structured “C” or Pascal source code. No license or runtime fees.

List: $695  Ours: $529
FAX: 3758-0001

Visio by ShapeWare
With Visio™ intuitive drag and drop drawing, everyone can create professional-quality graphics. Straightforward stencils, designed for everyday business drawings and technical diagrams, provide all the shapes you need. Whether you’re creating engineering schematics, network or block diagrams, org charts, programming flow charts, or your own custom drawings, Visio has a stencil of shapes that will make your job easier. GET A $70 VISIO PROGRAMMER’S STENCIL FREE WITH EACH COPY OF VISIO YOU ORDER!

List: $299  Ours: $225
FAX: 1006-2801

PRODUCT OF THE MONTH
Visual Basic for Windows by Microsoft Corporation
The fastest way to program for Windows just got faster. When you need to create a Windows application quickly, nothing offers the sheer productivity of Microsoft Visual Basic 2.0 Standard Edition. A visual development environment, flexible programming language, and fast runtime execution make this the shortest route to full-featured Windows applications. The Professional Edition includes messaging and data access capabilities, a wide variety of add-on tools, and more.

Standard Edition  List: $199  Ours: $139
Professional Edition  List: $495  Ours: $337
FAX: 1289-0039

Software that Sizzles!
MetaWare High C/C++
by MetaWare, Inc.

MetaWare, Inc. announces its newest product! The 32-bit High C/C++ compiler version 3.0 is a true compiler, not a C to C++ translator. "Incremental Strengths" let you specify the level of C++ compilation, allowing you to migrate from C to C++, one C/C++ block at a time. Included is a C++ tailored source-level debugger and a 32-bit Application Development Kit for Windows. MetaWare offers a full line of multi-language, multi-platform compilers for professional software developers.

List: $795  Ours: $669
FAX: 1-1590-0008

CA-dBFast Windows 2.0
by Computer Associates

The complete stand-alone dBASE/Xbase development language for MS Windows. Create fast, powerful, easy-to-use graphical applications. Over 200 extensions to the dBASE III PLUS language and includes an interactive editor, compiler, and linker. Challenge your creativity and imagination! Design multiple windows, pull-down menus, check boxes, list boxes, radio buttons, bit-map pictures, and more!

List: $550  Ours: $395
FAX: 1-1004-0003

CA-dBFast Windows 2.0
by Computer Associates

Microsoft Test
by Microsoft Corporation

MS Test for Windows makes comprehensive testing easier, reduces testing costs, and validates the quality of software as you write it. Deliver better applications for Windows in less time. Test the production version of any application for the Windows environment. Capture simple test scripts with a recorder or create sophisticated scripts in the TestBasic macro language. Reduce overall testing time and increase testing accuracy. Catch bugs faster and produce fully functional programs in less time for lower overall development costs.

List: $395  Ours: $275
FAX: 1-1269-0035

QuickForm Contracts
by Invisible Hand Software

An expert system for your PC that automates the drafting of fourteen categories of contracts most often needed by software developers and consultants. Prompts you with multiple choice questions and then automatically assembles a "near custom" agreement weighted to your side. QuickForm literally produces millions of variations of documents each in about 10 minutes. Port any document to your word processor for fine tuning by counsel. Saves time, money and lets you hit the table first with a document weighted in your favor.

List: $195  Ours: $175

SVS C3/FORTRAN-77
by Silicon Valley Software

Version V 2.8.2
SVS C3/FORTRAN-77 runs in and creates 32-bit executables for use with MS Windows 3.x as DPMI executables. Compiler, development tools and applications are DMPI conforming and support most VCPI requirements. Extensive graphics and scientific function library is included. Executables are run-time royalty free.

List: $395  Ours: $356
FAX: 1-2863-0001

BASIC Network Library
Network C Library
by Automation Software Consultants, Inc.

The most comprehensive libraries available for NetWare software development, supporting all versions of advanced NetWare including 3.11. Over 450 C functions and 300 BASIC functions. Include any features from the NetWare command line utilities and menu utilities in your C or BASIC program. No licensing hassles. Library source code available.

BASIC Library List: $265  Ours: $229
C Library List: $265  Ours: $259
FAX: 1-1004-9201

BASIC Network Library
Network C Library
by Automation Software Consultants, Inc.

PROTOGEN 3.0
by ProtoView Development

NEW VERSION! The industry standard for code generation and prototyping Windows applications. Develop the user interface of your application using visual prototyping methods. ProtoGen generates expert level, commented code for ANSI C. Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

List: $99  Ours: $95
FAX: 1-2553-0002

GUARANTEED BEST PRICES!
(Call for details)

To order call: 800-445-7899
Corporate (CORSOFT): 800 422-6507
FAX: 908 389-9227
International: 908 389-9228
Customer Service: 908 389-9229
For more information on the products featured on these pages call-
FAX: 908 389-8173

* All prices are subject to change without notice.

Circle 93 on Inquiry Card.
QMS 1725: New RISC, Old Reliability

The network laser-printer market has never been a playground. But with intensifying pressure from relative newcomers such as Compaq and veterans such as Hewlett-Packard, QMS has found it necessary to update its powerhouse 17-page-per-minute QMS-PS 1700 with the QMS 1725 Print System.

Among the biggest improvements the 1725 offers is an Intel 25-MHz 960-CF RISC processor. With an on-board 4-KB instruction cache and 1-KB data cache, it's a step beyond the 960-CA of the 1700. This product is the first to use the CF chip, which Intel announced last May. And where the 1700 included Adobe PostScript Level 1, HP PCL4 (Printer Control Language 4), HPGL (Hewlett-Packard Graphics Language) 7475A/7550A, and CCITT Group 4 fax, the 1725 has repackaged and enhanced this PDL (page-description language) support.

In place of Adobe PostScript Level 1 is QMS PostScript Levels 1 and 2, emulations of PostScript that follow the Adobe specification. (QMS already offers this in the 8-ppm QMS 860 Print System it announced last summer.) PCL4 is also standard; QMS expects to offer PCL5 later. Emulations of Group 4 fax (often needed for compatibility with compressed files even though QMS PostScript Level 2 includes it) and HPGL are sold together on an optional ($250) ROM card that plugs into one of two slots in the front of the unit. DeCnet users can purchase an LN03 Plus emulation for the 1700 or the 1725.

From the outside, the 1725 looks identical to the 1700. Before adding the two 500-sheet paper trays, the unit is a whopping 106 pounds. The prerelease version I looked at was fitted with 32 MB of RAM (8 MB comes standard), a $695 duplexing tray, a $795 internal 40-MB hard drive, and 38 of the 39 resident fonts the shipping product supplies. The 1700 comes with 45 fonts.

What the 1725 shares with its predecessor is a wealth of features that have kept the QMS presence strong in the market. The 1725 owes part of its appeal to the Canon NX engine, also present in HP's LaserJet IIIIs, and its 50,000-page-per-month duty cycle. A generous helping of interfaces keeps your options open: serial, parallel, LocalTalk, and a fourth you can use to connect directly to Ethernet (i.e., NetWare, EtherTalk, TCP/IP, or a combination DECnet and TCP/IP) or NetWare on token ring.

These interfaces would add up to little if not for the Crown technology QMS uses in several models to off-load document-processing duties from the host computer. The 1725, for example, lets you adjust the size of the buffers you've devoted to each interface to match expected traffic. Each interface can thus accept data simultaneously, spilling it over to common printer RAM or even to one or more hard disks (you can install up to six, counting external devices connected through the 1725's SCSI port). As much as 255 MB of data, if necessary, can spill over to disk, where it's treated as RAM.

Another important part of Crown is ESP (Emulation Sensing Processor) technology. A feature found in other vendors' products under different names, ESP analyzes incoming data and selects the appropriate language to keep you from having to switch settings in hardware or include software commands. A context-switching feature preserves the state of one emulation while you are using another.

Print jobs output alternately to the left and right edges of the 1000-sheet output tray to separate jobs. Multiple-copy runs are quickened through the 1725's storage of a page, in compressed form, in printer RAM to avoid the need for duplicative compilation and rasterization.

As for print quality, the 1725 offers 300 by 300 dots per inch or, for four times the dots for high-quality work, 600 by 600 dpi. Text output is crisp and legible even in small point sizes. Graphics images, notably at the higher resolution, are clean, and the curves are well delineated.

If the 1725 is any indication, anyone considering a printer for networks of up to 20 users may not have to look any further than QMS.

—Ed Perratore

THE FACTS

QMS 1725 Print System $5995
NetWare or EtherTalk Ethernet interface, $895
NetWare token-ring interface, $1095
QMS, Inc. 1 Magnum Pass
Mobile, AL 36618
(800) 631-2692
(205) 639-4400
fax: (205) 633-4866
Circle 1171 on Inquiry Card.

Making Presentations as Easy as 1, 2, 3

Lotus believes that many computer users who prepare presentations don't necessarily use presentation packages. Instead, they use word processors, spreadsheets, or other programs they're familiar with to produce overhead transparencies, slides, or handouts. As the old expression goes, "When all you own is a hammer, everything looks like a nail." That is, while these tools may get you through the presentation, they aren't a particularly elegant solution.

One challenge Lotus faces with Freelance Graphics for Windows 2.0, according to product manager Allison Parker, is getting people to use a presentation package. This may sound odd, considering that the market is crowded with excellent programs. As with word processors and spreadsheets, software companies are adding features to keep a step ahead of the competition.

But presentation packages aren't the same as word processors and spreadsheets,
"You mean I can order from IBM over the phone?"

**PS/ValuePoint™**

**433DX**

- i486™DX/33 MHz
- 120MB hard drive
- 8MB RAM
- Pre-installed OS/2® 2.0 (with DOS and Windows™ built in)
- 6312 SVGA NI 14" color display
- 3.5" diskette drive
- IBM mouse
- Internal i487™ math coprocessor
- 128KB L2 cache
- 8KB internal cache
- 1MB Video DRAM
- Industry standard compatibility
- Networkable
- 5 slots/5 bays

$1,999*

*Welcome to IBM Direct.*
PS/ValuePoint

**466DX2**

- i486DX2/66 MHz
- 212MB hard drive
- 8MB RAM
- Pre-installed OS/2 2.0 (with DOS and Windows built in)
- 6319 SVGA 15" color display
- 3.5" diskette drive
- IBM mouse
- Internal i487 math coprocessor
- 128KB L2 cache
- 8KB internal cache
- 1MB Video DRAM
- Industry standard compatibility
- Networkable
- 5 slots/5 bays

$3,119*

"It's everything I need now...and Novell®-certified..."

"It's not just slots and bays... It gives me lots of choices. And that feels great."

---

**325T**

- 386SLC™/25 MHz
- 80MB hard drive
- 2MB RAM
- Pre-installed DOS 5.0
- PS/2® 8511 VGA color display
- 3.5" diskette drive
- IBM mouse
- 5 slots/5 bays
- IBM enhanced keyboard
- Industry standard compatibility

$1,299*

"Three things hit me right off. Incredible power. Blazing speed. And getting a lot without paying a lot."

---

Every detail says IBM,
IBM Direct

Buy IBM by phone.
Quality, service, selection and price—just call IBM Direct. It's that easy to get IBM PC products delivered right to your door. Or for more information on IBM products, call our automated fax system at 1 800 426-3395.

Choose the best way to pay.
Easy payment methods—American Express, VISA, MasterCard, Discover card or personal check. Personal checks are subject to credit approval. Purchase order is available for qualifying customers.

Hundreds of IBM products.
The IBM Direct catalog highlights a broad range of other products such as application software, storage devices, memory options, connectivity adapters and much more. In addition, our 40-page catalog features other IBM PS/ValuePoint and ThinkPad configurations. And if you want a PS/ValuePoint system with DOS and Windows only, that is also available on certain configurations.

The HelpWare™ Advantage.
• One-year, on-site warranty for PS/ValuePoint products and ThinkPad 300.
• Three-year international warranty for ThinkPad 700 and 700C (in U.S., first year on-site).
• 24-hour 800# assistance, 7 days a week

• 4-hour service response time, on average
• 24-hour Bulletin Board and Automated Fax
• Hassle-free, 30-day money-back guarantee
• Plus 10,000 IBM service representatives at 1,600 locations backed by a $1 billion parts inventory

“Wow! It’s the biggest color screen I’ve ever seen.”

except the price.

CALL TO ORDER TODAY
1 800 IBM 2YOU
1 800 426-2968 8am-9pm EST Monday-Friday
"And with one phone call I can get all this, too?"

You bet. And much more. This page offers just a sampling of the more than 250 advanced technology products IBM Direct offers to help you keep pace with your changing computer needs. From IBM desktops, ThinkPads and displays to adapters, peripherals, software, network connectors, even multimedia options. Just give us a call. We’ll be glad to guide you to the IBM products most appropriate for your needs. We can also provide you with accurate specifications and answer any questions you may have.

<table>
<thead>
<tr>
<th>ThinkPad 700 and 700C Options</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data/Fax Modem (2400 bps/9600 bps)</td>
<td>$285</td>
</tr>
<tr>
<td>IBM PS/2 6MB IC DRAM Card</td>
<td>$905</td>
</tr>
<tr>
<td>IBM ThinkPad 486SLC2 Processor Upgrade</td>
<td>$549</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ThinkPad 300 Options</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data/Fax Modem (2400 bps/9600 bps)</td>
<td>$330</td>
</tr>
<tr>
<td>Port Replicator</td>
<td>$120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Systems and Application Software</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOS 5.0, Stacker V2.0 and 386MAX 6.0</td>
<td>$135**</td>
</tr>
<tr>
<td>OS/2 2.0, Upgrade from DOS</td>
<td>$99</td>
</tr>
<tr>
<td>WordPerfect® 5.1 for DOS</td>
<td>$355</td>
</tr>
<tr>
<td>Lotus® 1-2-3* for DOS</td>
<td>$355</td>
</tr>
<tr>
<td>Microsoft® Excel™ 4.0 for Windows</td>
<td>$335</td>
</tr>
<tr>
<td>Lotus Freelance Graphics® for OS/2</td>
<td>$425</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAN Communications</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Token Ring Network 16/4 Adapter for AT Bus</td>
<td>$535</td>
</tr>
<tr>
<td>EtherCard PLUS Elite 16 Combo™</td>
<td>$195</td>
</tr>
<tr>
<td>PC LAN Program 1.3</td>
<td>$185</td>
</tr>
<tr>
<td>NetWare® V3.11 (5 User)</td>
<td>$720</td>
</tr>
<tr>
<td>IBM OS/2 LAN Server 3.0, Entry</td>
<td>$505</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Printer and Printer Options</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Personal Printer Series II, 2390</td>
<td>$385</td>
</tr>
<tr>
<td>IBM ExecJet® Printer, 4072</td>
<td>$775</td>
</tr>
<tr>
<td>500-Sheet Second Drawer for 4019(E), 4029</td>
<td>$295</td>
</tr>
<tr>
<td>PostScript® Option for 4019(E), 4029</td>
<td>$335</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PS/ValuePoint Displays</th>
<th>Price*</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM 6312 Color Display</td>
<td>$405</td>
</tr>
<tr>
<td>IBM 6314 Color Display</td>
<td>$350</td>
</tr>
<tr>
<td>IBM 6319 Color Display</td>
<td>$860</td>
</tr>
</tbody>
</table>

IBM, OS/2, PS/2 and ExecJet are registered trademarks of International Business Machines Corporation. PS/ValuePoint, SLC, ThinPad, TrackPoint II and HelpWare are trademarks of International Business Machines Corporation. IBM, OS/2, PSNaluePoint Displays, IBM, ExecJet and PSNaluePoint are trademarks of IBM Corporation. The Intel Inside Logo, 486 and 487 are trademarks of Intel Corporation. Lotus is a trademark of Lotus International, Inc. Windows and Excel are trademarks of Microsoft Corporation. EtherCard PLUS Elite 16 Combo is a trademark of Standard Microsystems Corporation. Novell and NetWare are registered trademarks of the Novell Corporation. PRODIGY is a registered service mark and trademark of Prodigy Services Company. WordPerfect is a registered trademark of WordPerfect Corporation. Lotus, 1-2-3 and Freelance Graphics are registered trademarks of Lotus Development Corporation. Microsoft is a registered trademark of Microsoft Corporation. PostScript is a registered trademark of Adobe Systems Incorporated

IBM LaserPrinter
An IBM LaserPrinter 6 delivers up to 6-pages-per-minute performance, 300 dpi resolution for sharp images, and a variety of built-in type fonts.

$1,510*
which businesspeople typically use for several hours a day. People use presentation packages only when they need to make a presentation, so the learning curve must be easier and the benefits more immediate. Lotus has taken a step in the right direction with Freelance Graphics for Windows 2.0.

While version 2.0 offers megabytes of advanced features, the beta software I tested was inviting and even fun to use. More important, I produced a presentation in about an hour. After I added some more complex charts and played around with transitions, the entire process took only about 3 hours—not bad for someone whose presentation package up until now has been QuarkXPress.

A tutorial called QuickStart walks you through the process of creating a presentation. While some concepts may seem elementary to presentation pros, beginners will appreciate the effort.

To help you get up and running quickly, version 2.0 provides 65 SmartMaster designs (12 more than the previous version), ranging from simple and elegant to bright and boisterous. The templates have been optimized for black-and-white presentations. According to Lotus, while many users create in color, their handouts or overhead transparencies generally appear in black and white. Two small icons at the bottom of the screen let you easily toggle between color and black-and-white views.

The slide show, or SmartShow in Freelance Graphics parlance, has been improved to let you jump to other pages in the presentation, launch other applications, and play sounds or movies. You can select from 32 transitional effects—rain, paintbrush, and more—as you move from page to page. You also can draw on the page while it’s displayed—somewhat like John Madden doing his chalkboard analysis during NFL broadcasts.

Importing spreadsheets into Freelance Graphics for Windows 2.0 is a snap. You can import Lotus 1-2-3 and Symphony worksheets and Excel, dbase, and SYLK files. If you’re like me, though, you may find it easier to simply create charts from scratch rather than importing them from spreadsheets. Either approach is painless.

To help you stay focused during presentations, you can add speaker notes to each slide. A small icon in the shape of an index card reminds you which screens you’ve annotated. A collapsible outliner makes it easy to create or modify a presentation. You can also print your outline.

What would a product be today without multimedia support? Freelance Graphics for Windows 2.0 lets you spruce up your presentations with sound and video.

After using version 2.0 for a week, I feel as if I have only scratched its surface. That’s the beauty of it: Its features don’t get in the way of preparing a presentation.

—Dan Muse

**A National Voice for the PC**

With its first end-user product, National Semiconductor pulls no punches. The TyIN 2000 packs a 2400-bps data modem, a 9600-bps fax, voice mail, and business audio onto a single PC adapter card. A set of Windows applications delivers these diverse functions to your desktop.

The voice-mail manager handles all your phone messages. When you open a mailbox from the menu or by double-clicking on a mailbox icon, a log of messages is displayed in a dedicated window. You can play back your messages, record a greeting, or send a memo to another mailbox. If you assign a password to the mailbox, an unauthorized person cannot open the window. The TyIN supports multiple levels of mailboxes, letting you set up an access menu. You can retrieve your messages from a remote phone, and the toll-saver switches modes for reception of data, voice, or faxes on the same line.

A separate log tracks faxes. Double-clicking on an entry loads the fax image into a viewer. You can send faxes directly from the fax manager or from any other Windows application through a special printer driver. Faxing a file is then as simple as printing it. The card supports ECM (Error Correction Mode), a standard protocol on many dedicated fax machines that helps ensure high-quality output at the receiving end, and DFT (Document File Transfer), to enable the transmission of electronic files to other DFT-compliant fax boards. The TyIN automatically switches modes for reception of data, voice, or faxes on the same line.

Unlike other products in this category, the TyIN 2000 can also record and play back Windows audio (.WA V) files. You can append spoken comments to a document or spreadsheet that other users (with
WordPerfect Spruces Up Windows

WordPerfect is the leader of the pack in the DOS-based PC word processing software wars, but the Windows market is another story. WordPerfect doesn't dominate, but it's attempting to fight its way to the top with WordPerfect 5.2 for Windows. This product is an impressive upgrade to version 5.1.

In addition to adding a host of enhancements to the program, WordPerfect is also bundling Adobe Type Manager and Reference Software International's Grammatik 5 grammar checker. Among the version 5.2 enhancements are full OLE support, mail-enabling to support E-mail programs under the V1M and MAPI mail standards, new macros, import/export for Microsoft Word for Windows 2.0 and Lotus's Ami Pro 2.0, and the text indexing/retrieval feature called QuickFinder, which lets you quickly search file contents by keywords.

Take WordPerfect's stated memory requirement of 4 MB seriously. The beta version of WordPerfect 5.2 for Windows ran painfully slowly when working with only 2 MB of memory. However, after treating my Compaq Deskpro 386/20e to a long-awaited 4-MB memory upgrade, the updated version of WordPerfect took off. Running under 6 MB of RAM, WordPerfect 5.2 appeared nearly as fast as Microsoft Word for Windows 2.0, arguably its most formidable competitor.

One of the more intriguing aspects of version 5.2 is QuickFinder, for which WordPerfect is seeking a patent. With QuickFinder, which can be accessed easily from within the word processor itself, you can select certain files for indexing and then create an index that you can later search by filenames, keywords, phrases, or even Boolean operators. The indexes created by QuickFinder are relatively small. For example, indexing an entire 52-MB hard drive results in an index of about 1.6 MB in size. According to WordPerfect, QuickFinder builds index files equal to about 5 percent of the size of the selected files.

WordPerfect, which claims 1.5 million copies sold of version 5.1 for Windows, has thrown more than a few new bells and whistles into version 5.2. Users who purchased the DOS version of WordPerfect after April 1991 receive full licenses to the program under DOS, Windows, and OS/2. According to Devin Durrant, director of WordPerfect for Windows marketing, OS/2 is gaining momentum. And WordPerfect hopes to be the word processor of choice on that platform as well. ■

—Patrick Waurzyniak

THE FACTS

WordPerfect 5.2 for Windows $495
System requirements: A 20-MHz 386 or higher with a minimum of 4 MB of memory.

WordPerfect Corp. 1555 North Technology Way Orem, UT 84057 (801) 225-5000 fax: (801) 228-5077 Circle 1174 on inquiry Card.
Our goal at NEC is the complete integration of computers and communications. The Silentwriter Model 95fx is just one of many innovative products that help us to realize this goal. For example, we not only developed the first notebook computer with a built-in phone and fax, we make satellite dishes capable of sending data worldwide.

Once upon a time, all faxes looked the same. Bad. But with the Silentwriter® Model 95fx multifunction printer/fax, nothing gets lost in the transmission. Imagine PostScript™-language-quality faxes from your printer. It's no fairy tale. Now you can send and receive documents in all their original glory. You'll see beautiful fonts and graphics with none of the dirt and glitches, the jaggies and imperfections, that can turn a wonderful story into a tragedy. Why send a facsimile when you can send an original? Get the NEC Silentwriter Model 95fx multifunction printer/fax and live happily ever after.

And these facts.

1. A state-of-the-art 6 PPM laser printer equipped with Adobe's PostScript™ Level 2 and HP's PCL5.
2. Send and receive faxes in either conventional or PostScript-language formats.
3. Patented Sharp Edge Technology delivers 600 DPI-equivalent clarity.
4. Automatic interface switching supports both Macs and PCs.
5. Under $2,349 (MSRP). Far less than you'd pay for any printer/fax multifunction combination.

The Silentwriter Model 95fx Printer/Fax

Because ⦿ is the way you want to go. NEC

To upgrade your existing Silentwriter Model 95 printer with fax capability (U.S. only), or for more information about the Silentwriter Model 95fx, call NEC at 1-800-325-5500.

Circle 107 on Inquiry Card.
When you need business information, why not get the total story, instantly! Word for word. The McGraw-Hill Publications Online database gives you just that. Unedited, full-text retrieval (except graphics) of articles exactly as they are published in McGraw-Hill magazines and newsletters.

Now you can get information on companies, people and products on any topic—pertaining to one particular industry, or search the entire McGraw-Hill library (over 40 leading publications online) for diverse editorial perspectives. Only McGraw-Hill, the world’s foremost business information publisher, can deliver it all so completely—immediately! McGraw-Hill unabridged.

Access an entire universe of business information. Go online with our line. McGraw-Hill Publications Online. For more information, including our latest list of publications, contact Andrea Broadbent at (609) 426-5523. Or fax this coupon to (609) 426-7352.

Or send it to the address below.

Available through Dialog®, Dow Jones News/Retrieval®, NewsNet®, Nexis® and FT Profile (U.K.)
Now you can run X from virtually any hole in the wall.

There's really only one way to effectively run X from a phone jack—NCD's PC-Xremote Edition of PC-Xview. It's a special version of our X server software for PCs, one that doesn't require LAN support. Just install it on your laptop or home personal computer and you can run X out in the country, out of the country, or better still, in the comfort of your own home. For your very own copy or more information, call NCD at 1-800-793-7638. For just $199, we'll place the power of X right on your desktop. Wherever that may be.
**NEWS**

**WHAT'S NEW • SYSTEMS**

**CAD Power**

The Tri-CAD DX2-VL graphics workstations, based on the 50- and 66-MHz DX2 processors, are VESA VL-Bus–compliant and include graphics accelerators with ATI’s Mach-32 chips and 2 MB of VRAM (video RAM). This combination provides RISC-level performance with PC flexibility and ease of use, according to Tri-Star. The systems have 8 MB of RAM and 256 KB of secondary cache memory.

With a 32-bit VL-Bus Mastering SCSI-2 host that supports SCSI-2 hard drives of from 210 MB to 1.7 GB, the machines support up to seven SCSI devices. Other features include clock-doubling technology and 32-bit local-bus IDE hard drive controllers. A 17-inch Hitachi flat square color display is standard.

**Power Notebook**

With a 500-MB hard drive, Identity Systems' 386SX-25 notebook computer is well equipped for receiving faxes and hosting large applications. The 7-pound portable has a backlit VGA gray-scale display, 4 MB of RAM, an internal floppy drive, two serial ports, one parallel port, Windows 3.1, and Works. Modems and alternate memory configurations are optional.

**Portable Color**

EuroPak’s Eurocom 5500DX2C Super-Notebook has more power than many desktop systems. Packed into the 50-MHz 486DX2’s 5.5-pound frame are a 120-MB hard drive, a floppy drive, 4 MB of RAM (expandable to 8 MB), and a passive-matrix triple-supertwist 9-inch LCD, capable of displaying 256 colors at 480-by-640-pixel resolution. Standard interfaces include two serial ports, a parallel port, and ports for an external VGA monitor, a keyboard, and more.

To save energy, the notebook has sleep and smart-sleep modes. The detachable battery pack provides power for up to 2½ hours. The docking station option includes two 16-bit slots, a keyboard port, two serial ports, and one parallel port.

**Talk to Your Notebook**

The custom-designed Wen 486 SuperNote-Voice color notebook includes a tele-marketing-style headset with a microphone that lets you send verbal instructions to the unit. Wen's proprietary voice-recognition software features as many as 1000 isolated words or phrases with better than 98 percent accuracy. Also included are concurrent operation of voice recognition and unlimited text-to-speech synthetic voice output.

The notebook's basic configuration has 2 MB of RAM (expandable to 10 MB), 128 KB of ROM, and 8 KB of cache memory. It also includes a 60-MB hard drive and a 387 coprocessor socket.

**First Computers**

Canon’s entry into the computer market brings with it two 25-MHz 486SX machines. The Innova 486 desktop is upgradeable to all 486-based microprocessors, including the 66-MHz DX2. The system has a color Super VGA monitor, 4 MB of RAM, 8 KB of internal and 64 KB of external cache memory, a 130-MB hard drive, and dual floppy drives.

The 5.8-pound Innova 486NX color notebook is upgradeable to a 50-MHz 486DX2 unit. It has 4 MB of RAM (expandable to 12 MB on-board), 8 KB of internal cache memory, a 120-MB hard drive, and a 1.44-MB floppy drive. The just-over-9-inch screen is a passive-matrix color VGA LCD with 16 colors. Interfaces include a PCMCIA expansion port and a PS/2 mouse port. A Logitech TrackMan mouse and a nickel-metal-hydride battery are standard.
CD-ROM Made Easy

Available in a slim portable case or as a cube, the Venturer CD-ROM drive conforms to the ISO 9660/High Sierra standard and is compatible with CD-ROM modes 1 and 2. A top-loading mechanism frees the front of the unit for a hi-fi audio CD-player control panel that lets you play music without PC software.

The Venturer features a proprietary interface or an optional parallel port interface for notebook compatibility. With the MS-DOS CD extension, the unit is multimedia applications-compliant. The data transfer rate is 150 KBps, and the average access time is 800 ms. The drive, which has a 2352-byte buffer, can read standard 12- and 8-cm CDs.

Price: $179.
Contact: North-East Microcomputer, Ltd., Markham, Ontario, Canada, (416) 513-6800; fax (416) 513-6802.

Circle 1136 on Inquiry Card.

Data in Large Chunks

Capable of up to 12 GB of uncompressed data storage via 12-mm proprietary DAT (digital audiotape) technology, the VDAT SCSI data-storage system provides more than 25 GB of compressed data storage at a 2-to-1 average compression ratio. Sustained data transfer rates for the unit reach 2500 KBps. The PC-compatible VDAT comes with 56-bit and full Reed-Solomon error-correction code.

Price: $1,195.
Contact: TenTime, a division of Laura Technologies, Inc., Chandler, AZ, (602) 940-9800; fax (602) 940-0222.

Circle 1137 on Inquiry Card.

Monitors for Different Uses

The HM-6421 21-inch, 2-megapixel-resolution color monitor has 1600-by-1280-pixel, 28-mm-dot-pitch flat-screen vertical scanning of 72 to 77 Hz. The monitor uses Hitachi’s proprietary analog dynamic convergence circuitry for a misconvergence of 25 mm in the center viewing area and 35 mm in the perimeter. The company’s patented Elliptical Aperture Dynamic Focus System passes electron beams through an elliptical rather than a round aperture in peripheral areas and then controls the beams for sharp images throughout the screen.

Price: $5345.
Contact: Hitachi America, Ltd., Office Automation Systems Division, Montvale, NJ, (201) 573-0774; fax (201) 573-7660.

Circle 1138 on Inquiry Card.

The Venturer CD-ROM has a 150-KBps data transfer rate, an 800-ms average access time, and a 2352-byte buffer.

ViewSonic 15’s appeal. The display’s 1024-by-768-pixel resolution has refresh rates of up to 76 Hz, and the 28-mm dot pitch provides depth and clarity to images. Invar shadow-masked technology makes the images bright and crisp. The monitor automatically adjusts to horizontal scan frequencies of 30 to 64 kHz. You can store up to 26 programmable settings in memory on the monitor, which is IBM- and Mac-compatible.

Price: $849.
Contact: ViewSonic, Walnut, CA, (800) 888-8583 or (909) 869-7976; fax (909) 869-7958.

Circle 1140 on Inquiry Card.

Port Sound to Your System

A plug-and-play external sound system, Digi-speech Port-Able Sound adds CD-quality audio to your PC. The system automatically loads its software drivers when you initially plug it into your computer’s parallel port. With a pass-through that lets your printer continue functioning, Port-Able Sound senses whether files going through the port are intended for the printer or for itself.

System features include a built-in speaker and microphone, an on/off switch with an LED that indicates when the sound is turned off, input jacks for a CD player, output jacks for external speakers, audio stereo sound, and Lotus Sound software. The system is compatible with Windows 3.1, Windows Multimedia Extensions, SoundBlaster Pro, and Pro Audio Spectrum.

Price: $189.95.
Contact: Digispeech, Inc., Placerville, CA, (916) 621-1787; fax (916) 621-2093.

Circle 1141 on Inquiry Card.
Speed and Color on Plain Paper

Able to print 2 ppm, the Phaser 200i and Phaser 200e 300-dpi printers print on transparencies and common office paper. The printers use Tektronix's new P2T2 technology, which incorporates proprietary image-processing techniques and a custom transfer ribbon to apply a transparent primer coat on the paper only where needed. The printers also use Tektronix's proprietary TekColor color management and image-rendering technologies and offer the TekColor Display Adjust and Blue Adjust options.

The Phaser 200 Series printers include parallel, serial, and AppleTalk ports with automatic switching among them. The company's 4511A network interface provides TCP/IP and DECnet connectivity, and an optional EtherTalk interface is available for the Phaser 200i. The Phaser 200i comes with 6 MB of expandable memory; the Phaser 200e has 4 MB. In addition to PostScript Level 2 page description software, the printers support HPGL (Hewlett-Packard Graphics Language).

Price: Phaser 200e, $3695; Phaser 200i, $5995.
Contact: Tektronix, Inc., Wilsonville, OR, (800) 835-6100 or (503) 682-7377.
Circle 1142 on Inquiry Card.

Rugged Forms Printer

A high-speed, high-precision, dual-head impact printer designed for long-range printing of multiple forms and heavy card stock, the TXP-800 form printer feeds, prints, and sequentially stacks forms, tickets, or cards. The nine-pin dot-matrix printer achieves burst speeds of up to 415 cps for 231 lpm.

The TXP-800's bit-mapped graphics capability lets you print at densities of 60, 120, and 240 dpi. You can also print bar code graphics of dot-matrix quality at high-density settings and set character spacing at 10, 12, or 17 per inch. The printer includes IBM Proprinter emulation with simplified programming instructions.

Price: $1925.
Circle 1144 on Inquiry Card.

Print in Pantone Colors

The SpectraStar Q10 color thermal wax-transfer printer features Pantone-certified color matching and a three-color ribbon. The PostScript Level 2-compatible printer has 6 MB of RAM (expandable to 10 MB) for print spooling—letting the unit store copies of a document in memory—and a 20-MHz RISC processor. The printer supports PCs, Macs, and shared environments.

Price: About $6634 (£4350).
Contact: Reflex, Ltd., Reading, Berkshire, U.K., +44 734 313611; fax +44 734 314439.
Circle 1145 on Inquiry Card.

Print Graphics on This One

Rother's HL-10PS 300-dpi laser printer incorporates the company's BRScript PostScript language interpreter, which also provides full support for Adobe Type 1 and Multiple Master fonts. In addition, the HL-10PS emulates the HP LaserJet III.

Standard features on the 10-ppm printer include automatic interface and emulation switching, 37 resident fonts, high-resolution control, and data compression. Standard interfaces include Centronics parallel, AppleTalk/RS-422A serial, and RS-232 serial ports. The HL-10PS supports unlimited gray shades in BR-Script mode and 64 shades in PCL (Printer Control Language) mode. The display and control panel tilts upward for ease of operation and readability; printer messages can be set in six languages.

Price: $2395.
Circle 1144 on Inquiry Card.

Network Color Printing

The Codonics NP-600 color network printer uses dye-sublimation technology to produce photographic-quality images. Designed to work with any homogeneous or heterogeneous TCP/IP network, the printer connects to existing Ethernet or token-ring networks. It uses the industry-standard TCP/IP protocol to print files originating from DOS, Unix, and DEC VMS systems. Host computers do not require any special software drivers.

The printer automatically identifies the transmitted image's file format by recognizing header information embedded in every file, so you don't need to specify the file format types. Image file formats that the Codonics NP-600 recognizes include TIFF, GIF, PCX, Macintosh PICT, Sun raster, Portable Pixmap, and X11 Bitmap. With 16.7 million simultaneously printable colors, the printer can produce continuous-tone format prints.

Price: $12,500.
Contact: Codonics, Inc., Middletown Heights, OH, (800) 444-1198 or (201) 243-1198; fax (216) 243-1334.
Circle 1271 on Inquiry Card.

The Codonics NP-600.
Why do they call it a dongle?

He wasn't famous. He didn't drive a fancy car, but dressed in his favorite Comdex T-shirt and faded blue jeans, he set out to change the course of the computer software industry. Quite a task for a lonely software developer.

Sitting in front of his computer, drinking pots of coffee and smoking cartons of cigarettes, he'd write pages of code.

It took time. Years in fact. But he did it. He wrote the most powerful computer program in the world. Now came the hard part. Selling it.

The Most Powerful Program in the World

Determined to make those long years pay off, he called on every distributor, VAR and dealer in the world. He drove from Beantown to San Diego. Flew from Dublin to Borneo. Everyone loved the program.

So he sold a few. Only a few.

Back in Boston he waited. After a long year with only 13 orders he set out to see what happened. As he drove across the country and flew around the world he discovered everyone knew about his program. Everyone had it too.

The Global Marketplace

From Paris to Prague, his program was everywhere in Europe. When he got off the plane in Hong Kong he found his program stacked to the ceiling in every computer store. Amazed in disbelief, he bought a hundred cartons of cigarettes and a hundred pounds of Indonesian coffee and flew back to Boston.

Beaten, battered and bruised he went back to the drawing board. This time he would really change the face of the software industry. He would develop a device that would prevent unauthorized distribution of software programs.

Call It What You Like

He developed a hardware key. His peers applauded his efforts. Finally, a solid solution for revenue protection.

But he didn't know what to call it. He thought of naming it after an exotic place he visited in his travels. Madagascar was a bit too long, though.

"Name it after you, Don!", urged his peers. So he did. Soon everyone was calling the key a dongle, after Don Gall— the lonely software developer who did what he had to do.

You've Come A Long Way, Baby

Today, dongles are different. Fact is, they've come a long way. Leading the industry with security solutions, Rainbow Technologies has changed the face of hardware keys. They work with multiple applications, are programmable and network versions control concurrent usage. And they're always transparent to the end-user.

Sentinel Family from Rainbow

Truth is, more and more developers are using keys. And the Sentinel Family is the most widely used in the world. In fact, over 6,000 developers use Sentinel from Rainbow. Why? They are simply the most effective, reliable and easy to implement keys on the market.

Learn more about securing your software and how keys provide developers with extra value. Call for a free copy of "The Sentinel Guide to Securing Software." And see just how easy it is to install a hardware key into your application in just minutes. Try it with our low cost Sentinel Evaluation Kit. Order one for your DOS, OS/2, Windows, Macintosh or UNIX based application.

And remember, when you need a dongle, you need Sentinel — the only dongle Don Gall would use.

CALL 800/852-8569 FOR YOUR FREE GUIDE TO SECURING SOFTWARE

Some call it a dongle. Those who know, call it Sentinel.
PRODUCTIVITY PARADISE:

It's a CD player that plays ideas. It's computer technology that sings, and makes business information move and talk.

The Sony Multimedia CD-ROM Player. See how it can make your productivity blossom.

To receive product information and dealer locations, call 1-800-937-SONY, ext. 333.
Full-Motion Video

Windows 3.1-compatible, the VideoSurge 24-bit full-motion video board has audio pass-through and lets you select your video source from NTSC, SECAM, or PAL. Super-VHS is available as an option.

You can scale the video windows to any size, zoom them, and choose to have your scaled image fit or not fit in windows. If you choose the latter, you can do real-time panning and framing to display only a portion of the video. The board supports Super VGA resolutions of up to 1024 by 768 pixels.

As a video capture board, VideoSurge captures images into graphics file formats such as Bitmap, PCX, Targa, and TIFF. You can individually select and control the board’s three sets of stereo inputs, each with volume, bass, treble, and balance control.

Price: $995; with S-VHS input, $1095.
Contact: Aitech International, Milpitas, CA, (800) 882-8184 or (408) 946-3291; fax (408) 946-3597.
Circle 1272 on Inquiry Card.

Digital I/O Control

The Quick Control Board puts data acquisition and control capabilities in your PC or Mac via the RS-232 port. Each of the board’s 16 digital I/O lines has its own LED. Four 8-bit A/D converters can digitize signals between 0 and 5 V. At 19,200 bps, individual lines can be set up at 1920 state changes per second and read at 960 samples per second; A/D converters can also be read at 960 samples per second. Other features include a built-in null-modem switch, and two auxiliary 5-VDC power outputs drive external devices.

Price: $220.
Contact: Intelligent Automation, Inc., Rockville, MD, (301) 990-2407; fax (301) 990-2409.
Circle 1274 on Inquiry Card.

Resolution Boost

Get 600- by 600-dpi resolution and automatic network capability on your Hewlett-Packard LaserJet II Series printer with the ImageUp board. The board installs in the base of the printer to replace the printer’s controller board.


Price: $1495.
Circle 1273 on Inquiry Card.

DSP-Based Multimedia

An accelerator board that’s a DSP (digital signal processor)-based multimedia application development platform, the QuantumDSP board is based on AT&T’s 27.5-MFLOPS DSP3210. With VCOS (Visible Caching Operating System) and VMDE (VCOS Multimedia Development Environment), the board lets designers implement PC-based functions such as data and fax modems, audio and image compression, and CD-quality stereo. The DSP and the host PC can access the 2 MB of 70-second DRAM on the ISA-compatible board.

Price: QuantumDSP, $595; VMDE, $3000; DSP3210 design tools, $2000.
Contact: Communication Automation & Control, Inc., Allentown, PA, (800) 367-6735 or (215) 776-6669; fax (215) 770-1232.
Circle 1275 on Inquiry Card.

Put Your Graphics on TV

VGA2TV Pro displays computer graphics on a TV screen or VCR in up to 256 colors. The board supports NTSC or PAL; it overlays PC graphics on an input video source such as a VCR and outputs them onto videotape or TV. Compatible with any VGA board with a standard feature connector, the board features a full-frame buffer and supports text and graphics at up to 640- by 480-pixel resolution.

Price: $895.
Contact: Genoa Systems Corp., San Jose, CA, (800) 934-3662 or (408) 432-9090; fax (408) 434-0997.
Circle 1276 on Inquiry Card.
Yes, it's definitely time you expanded your view to the non-interlaced 15" ViewSonic 6FS monitor.

For one thing, you get 36-percent more viewing space than with a standard 14" monitor. And, since you can display more information on the screen with the larger 15" flat square screen, this is an ideal monitor for Windows, Graphical User Interface (GUI) and desktop publishing environments.

Thanks to the ultra high 72Hz refresh rate with resolution up to 1,024 x 768, the ViewSonic 6FS produces the most vivid and precise flicker-free image anywhere. In addition, the non-glare screen reduces irritating reflections.

The monitor, compatible with all standard resolutions, features 32 programmable modes with digital controls to store and customize the display to fit your specific needs. It also is certified to meet strict MPR-II Swedish certifications for low emissions, which makes it environmentally safe. It's a fact— the ViewSonic 6FS offers special features normally available only on larger, more expensive monitors.

Expand your view, not your budget, with the affordable 15" ViewSonic 6FS monitor.

ViewSonic®
20480 E. Business Parkway
Walnut, CA 91789
(714) 869-7976  (800) 888-8583  Fax: (714) 869-7958

For immediate faxed information, call the FaxSonic "hot line" at (714) 869-7318—it's available 24 hours a day.

All products and brand names are registered trademarks of their respective companies.

Circle 146 on Inquiry Card (RESELLERS: 147).
Windows Command and Control

A self-contained command center for use under Windows, the PowerTrac trackball system includes a two-button mouse, a trackwheel, and three programmable buttons. The PowerTrac is designed to intuitively enhance your ability to interact with Windows 3.1 applications.

TRAC.DRV, the Windows 3.1 control panel driver, provides user-definable ballistic gain, tracking speed and sensitivity, button functionality, drag lock assignment, and AutoDrag control. AppTrac software for Windows automatically senses which application is active, allowing the PowerTrac to respond with commands for the proper Windows application as you switch among them.

Price: $149.
Contact: MicroSpeed, Inc., Fremont, CA, (510) 490-1403 or fax (510) 490-1665.
Circle 1277 on Inquiry Card.

The Travel Connection

The Konexx Kit provides all the tools you need to connect your fax modem to any telephone in the world. Once connected, you can communicate at speeds up to 9600 bps. The kit includes the Konexx Kooler Model 203, a Merlin Phone Adapter, and a 9-V battery.

Price: $169.
Contact: Unlimited Systems Corp., San Diego, CA, (800) 275-6354 or (619) 277-3300; fax (619) 277-3305.
Circle 1278 on Inquiry Card.

Toss Out the Clock Battery

With the Permanent Power Pack (model PPP-001), you no longer need to replace your PC’s clock battery. In place of the battery, the IC-based unit manages input power and regulates output power for the life of your PC. Installation requires no PC modifications, according to the company.

Price: $49.95.
Contact: MicroApps, Sunnyvale, CA, (408) 735-1015.
Circle 1279 on Inquiry Card.

Receive Faxes by Moonlight

Resembling a normal font cartridge, the Moonlight PrinterFax cartridge lets you receive faxes on a Hewlett-Packard LaserJet printer. The cartridge plugs into any HP LaserJet Series II, IID, IIP, III, IIIID, or IIP printer to give you plain-paper fax capability. Able to switch automatically between printer and fax modes, the cartridge provides precise date and time stamping.

Price: $259.
Contact: Moonlight Computer Products, Inc., San Diego, CA, (619) 625-0300; fax (619) 625-0199.
Circle 1280 on Inquiry Card.

Safe CD-ROM Movement

Now you can safely move your CD-ROM discs between their storage cases and your CD-ROM drive. The Disclift acts as an extension of your hand to let you handle the disc by its outer edges or engage the disc from its center. The lightweight device adapts to carousel players, magazine cartridges, and CD-computer caddies.

Contact: The Audio File Co., Phoenix, AZ, (800) 662-0224 or (602) 272-2809.
Circle 1281 on Inquiry Card.

Digital Battery Management

A digital on-line battery backup device, the Perfector Series UPS (uninterruptible power supply) uses all incoming power and converts it to a simple energy level. A processor then converts the imperfect power into perfect AC power.

Price: $1599.95.
Contact: DSK, Inc., Orem, UT, (801) 224-4828; fax (801) 224-5872.
Circle 1282 on Inquiry Card.

Cable Diagnostician

A hand-held network cable diagnostics tool for coaxial and unshielded twisted-pair cable, the MT350 Scanner is designed for multiple types of networks. You can print the results to a portable printer, download them to the scanner’s PC-based CMS (cable management system), or integrate them into any database.

Price: Scanner kit, about $4575 (£3000); CMS, about $534 (£350); portable printer option, about $450 (£295).
Contact: M-Group, London, U.K., +44 81 877 1711; fax +44 81 874 7265.
Circle 1283 on Inquiry Card.
Finally.

Four years after Ashton-Tate promised it to you, CA is proud to deliver the CA-Clipper/Compiler Kit you've been waiting for.

Now you can compile most dBASE IV applications in just three easy steps. First, create an application using all the dBASE IV tools you're already familiar with. Next, test and optimize the code to ensure it performs to specifications. Then use the DPREP program to compile it and produce an executable .EXE file that gives you all the speed and efficiency CA-Clipper® is famous for.

The CA-Clipper/Compiler Kit For

dBASE IV provides compatibility and database interoperability with most dBASE IV applications. And it's implemented using the open architecture of CA-Clipper, including the pre-processor, the Extend System and the RDDs.

Call 1-800 CALL CAI for the name of your nearest dealer and a free statement of direction entitled "The Future of Xbase". Call right now. Haven't you waited long enough?

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11756-7000. 1-800 CALL CAI. dBASE and dBASE IV are registered trademarks of Borland International, Inc. All product names referenced herein are trademarks of their respective companies.

Circle 76 on Inquiry Card.
Going to Extremes

If you want to know what the Gateway 2000 Nomad notebook PC can endure, just ask mountaineer Wally Berg. He took the Nomad 425DXL with him last fall on an expedition to the highest point on earth — the majestic, 29,128-foot Mount Everest in the Himalayan Mountains of Nepal.

Wally used the Nomad daily to track supplies, budget, and events of the climb. “Despite being transported over rugged terrain by yak, and operating in an unheated tent with temperatures outside of 20 to 30 degrees below zero, the Nomad performed flawlessly,” said Wally. “The size was perfect, too. We had so many supplies to carry that size and weight were a big consideration.”

Wally powered the Nomad with three sets of NiCad batteries which he recharged with a solar panel. Wally said the batteries weren’t affected by the frigid temperatures. Each battery always lasted up to six hours.

The expedition left for its final climb to the Everest summit shortly after midnight on October 9. They ascended toward the peak by moonlight, reaching the top at 8 a.m. “It was a feeling of total exhilaration to finally reach the highest point in the world,” said Wally.

Even if you don’t plan to take your Nomad to Mount Everest, it makes the perfect traveling companion wherever you journey. The Nomad weighs just 5.6 pounds and measures 8.5 x 11 x 1.8 inches. Standard features include: a 25MHz Intel® 486SX or 486DX processor; 4MB RAM; an 80MB hard drive (425SXL model) or a 120MB hard drive (425DXL model); a 3.5-inch diskette drive; a 10-inch backlit VGA screen; a comfortable 79-key keyboard and FieldMouse™ portable pointing device; MS-DOS®, Windows™ and Works for Windows™. Perhaps the most attractive feature is the price:

Nomad 425SXL ■ $1995    Nomad 425DXL ■ $2695

A Nomad gives you portability, 486 desktop performance, a great screen and keyboard, outstanding battery life — plus incredible durability. So take it from Wally Berg. If the Gateway Nomad can endure an Everest expedition, it can take almost anything!
Voice/Fax for Windows

You can use Ibex Technologies' FactsLine for Windows software for document-retrieval applications such as customer service, literature fulfillment, and forms distribution. The interactive voice/fax package offers fax-on-demand, fax-broadcasting, and voice-processing functions that you can configure and implement in the Windows environment.

A pop-up scripting feature lets you compose and script the contents of voice announcements before you record them, and a simulation feature lets you test an application using the screen and mouse, instead of the telephone. The software also provides dated documents that automatically become inactive; on-line reconfiguration and updating of applications, voice announcements, and fax documents; a database-driven report generator; a visual voice editor; and document conversion tools.

FactsLine for Windows is also integrated with a voice-processing system to help direct calls through a multilevel voice-menuing system. This interactive voice response transfers callers to the appropriate mailboxes and permits them to leave messages after they have retrieved their requested documents.

Price: $6500.
Circle 1289 on Inquiry Card.

High-Speed Connectivity

Two high-speed connectivity products, the SunLink Frame Relay and the SunLink PPP, allow applications that you traditionally use on LANs, such as client-server databases, multimedia, the X Window System, and NFS (Network File System) applications, to run faster and more economically over global networks. You can also use both products with SunNet Manager to manage multivendor networks at local and remote sites.

The SunLink Frame Relay provides transparent IP connectivity to frame-relay networks over one or more links that can communicate at up to T1/CEPT speeds. You can have up to 1022 virtual point-to-point connections over each physical connection and obtain frame-relay virtual-circuit statistics.

The SunLink PPP allows communication at up to T1/CEPT speeds beyond LANs to global networks. SunLink PPP can route TCP/IP traffic over point-to-point links by using the Internet PPP.

Price: $1150 each.
Contact: SunConnect, Mountain View, CA, (415) 960-1300; fax (415) 969-9131.
Circle 1287 on Inquiry Card.

EISA-to-SCSI Disk Array Controller

The Ultra 124F, an EISA-to-SCSI disk array controller, supports up to eight logical arrays, each of which can be virtually any capacity and any RAID level. The full-length card can support up to 35 SCSI-1, SCSI-2, and Fast SCSI-2 hard drives; provides complete redundant using RAID levels 0, 1, 4, and 5; and comes with UltraArray, a utility that lets you configure multiple arrays of mixed types and capacities.

The basic card comes with three Fast SCSI channels that you can expand via the optional 124FEX daughterboard, which adds two channels internally, or the optional 124FXT/3 and 124FXT/5 expansion boards, which add, respectively, three and five channels externally to the computer. The Ultra 124F supports DOS, Windows, NetWare, OS/2, and Unix operating environments.

Contact: UltraStor Corp., Fremont, CA, (510) 623-8955; fax (510) 623-8953.
Circle 1285 on Inquiry Card.

PCMCIA Fax Modems

With OmniTel's Business Card 2496c and 2496c+ PCMCIA Type II fax modem cards, you can send and receive Group 3 faxes at 9600 bps from your portable computer. Both modems are identical except that the Business Card 2496c+ adds flash memory, MNP level 10, and support for the Cellular Phone Interface.

Features include automatic fallback from 9600 to 7200/4800/2400 bps and from 2400 to 1200/300 bps; 2400-/1200-300-bps data transfer; MNP levels 2-4 and CCITT V.42 error correction; and MNP level 5 and CCITT V.42bis data compression.

Price: Business Card 2496c with DOS software, $349; with Windows software, $375; Business Card 2496c+ with DOS software, $399; and with Windows software, $425.
Contact: OmniTel, Inc., Fremont, CA, (510) 490-2202; fax (510) 490-1285.
Circle 1286 on Inquiry Card.

Micro Fiber Optic Transceiver

A compact adapter, the Transcast EN-4322 Micro Fiber Optic Transceiver provides direct connection of Ethernet-based computers, servers, workstations, and peripherals to fiber-optic, 10Base-FL/FOIRL networks. The EN-4322 features six diagnostic LEDs that indicate Jabber, Link, Collision, receive data, transmit data, and power, as well as a user-selectable Signal Quality Error switch.

Price: $325.
Contact: Lancast, Amherst, NH, (800) 752-2768 or (603) 880-1833; fax (603) 881-9888.
Circle 1288 on Inquiry Card.
IN REVIEW AFTER REVIEW, Jumbo takes top honors. PC Magazine's exclusive Editors' Choice is the 12th award in the last year. Which proves Jumbo is a backup value that can't be beat. Jumbo gives you top performance, yet it's easy to use. Choose either Jumbo 120 (120 MB with data compression) or Jumbo 250 (250 MB with data compression). Both give you QIC compatibility, Novell® Certification and UNIX®/Xenix® support. Call 1-800-451-0897, ext. 163 today for a free brochure.

COLORADO® MEMORY SYSTEMS
800 S. Taft Ave., Loveland, CO 80537

Novell, UNIX and Xenix are registered trademarks of their respective companies. © 1992 Colorado Memory Systems, Inc. All rights reserved. 

Circle 68 on Inquiry Card (RESELLERS: 69).
To a software developer, this is what heaven looks like.

Most people wouldn't know what to make of a screen like this. But developers like you know a screen like this can help make all kinds of applications. With OS/2® 2.0, you can develop the DOS, Windows®, OS/2 and host-based apps end users need. And you can do it faster and easier than ever before. Because OS/2 2.0 can make the most of your 386 or 486 processor.

Now you can edit in one window, compile in another, profile in a third and test in a fourth. Preemptive multitasking makes everything run smoothly and responsively. And OS/2 Crash Protection™ helps shield running applications from each other, so if one goes down it won't affect the others. Instead of rebooting, you just restart the affected app and continue.

And since OS/2 2.0 is a 32-bit operating system, programs are easier to write and run faster, too. Which all adds up to improved productivity and reduced development cycle time.

But maybe the best part is that for less than the cost of DOS and Windows, OS/2 gives you a whole lot more. And to keep your cycle rolling, a full range of services and support are available, like on-line help through OS/2 Support line, Bulletin Board and IBM Link. Or you can join the IBMOS2 and OS2DEV conferences on CompuServe, where you can meet IBMers, users and developers who can find fast answers to your questions. For an IBM authorized dealer near you, or to order OS/2 2.0 from IBM, call 1 800 3-IBM-OS2:

- OS/2 Crash Protection helps shield applications from each other.
- The integrating platform of choice for DOS, Windows and OS/2.
- Preemptive multitasking for responsive, reliable execution.
- 32-bit flat address space for productive programming.
- A full range of IBM services and support.

Circle 89 on Inquiry Card.
GUI Tools for X Developers

With DynaGraphX, you can build Motif GUIs containing real-time graphs, meters, and dials, and generate all the Motif C code you need to implement your interface. The DynaGraphX package includes X-Designer, the DataViews Graph Widgets, the Color Threshold Table Editor, convenience functions, and sample programs.

A Motif GUI builder, X-Designer includes a layout editor, a WYSIWYG design window, and a widget selection palette. DataViews Graph Widgets contains 40 real-time graphs, meters, and dials; the Color Threshold Table Editor lets you tie color thresholds to your graphs; and the convenience functions simplify resource setting and object creation.

Price: DynaGraphX development license, $7000.
Contact: V.I. Corp., Northampton, MA, (413) 586-4144; fax (413) 586-3805.
Circle 1294 on Inquiry Card.

CASE for Windows

A CASE tool set for Windows, Visible Analyst Workbench 5.0 provides an integrated forward- and reverse-engineering environment that helps you through the planning, design, and analysis of the application development process. The package helps you generate SQL database schemata, COBOL source code, and C source code from designs you have developed in the system.

Visible Analyst Workbench includes multipage document support, model navigation improvements, control-bar support, repositionable editor windows, and object creation. You can build and optimize the software development cycle. The modular system includes tools that guide you through the data dictionary and application dictionary, prototyping and simulation, generation of source code and the database, compilation and linkage, documentation, and maintenance support.

The CASE for Clipper package supports C++ templates, including the browser, debugger, and interactive workspace. It also includes enhanced debugging, fast object-code run-time error checking, advanced dynamic-code and data-visualization capabilities, and support for OpenLook and Motif. In addition, ObjectCenter 2.0 includes the C development capabilities found in CodeCenter, CenterLine’s Unix C programming environment, providing a C and C++ mixed-language development capability.

Price: $3995.
Contact: CenterLine Software, Inc., Cambridge, MA, (617) 498-3000; fax (617) 868-6655.
Circle 1297 on Inquiry Card.

Pen Application Builder

You can use the PenApps Application Builder 1.0 to create forms-based and data-intensive applications for pen-based computers. The package, which runs on Windows for Pen Computing and PenPoint, includes a screen/forms designer, a built-in database, and the Slate PenBasic programming language. You can build into your applications pen-centric features such as ink as a data type, input targeting, markup mode, switch to ink, deferred translation, gesture support, cursorless operation, coerced translation, and sketch fields.

With the PenApps Application Builder, application components are identical for both operating systems. You can compile PenApps applications from one platform to another, yet still take advantage of operating-system-specific capabilities such as DDE under Windows for Pen Computing and Embedded Document Architecture under PenPoint.

Price: $1895 and up.
Contact: Visible Systems Corp., Waltham, MA, (617) 890-2273; fax (617) 890-8909.
Circle 1295 on Inquiry Card.

C++ and OOP

CenterLine Software has added precompilation of header files, demand-driven generation of program information, and support for C++ templates to ObjectCenter 2.0, the latest version of its Unix C++ programming environment. Version 2.0 also offers a C++ interpreter and integrated run-time error detection that let you reuse code and use, understand, and develop C++-class libraries.

The package supports C++ templates, including the browser, debugger, and interactive workspace. It also includes enhanced debugging, fast object-code run-time error checking, advanced dynamic-code and data-visualization capabilities, and support for OpenLook and Motif. In addition, ObjectCenter 2.0 includes the C development capabilities found in CodeCenter, CenterLine’s Unix C programming environment, providing a C and C++ mixed-language development capability.

Price: $3995.
Contact: CenterLine Software, Inc., Cambridge, MA, (617) 498-3000; fax (617) 868-6655.
Circle 1297 on Inquiry Card.
Since April 7, 1992

Raima Database Manager was the database of choice in the First Annual Windows World Open. The competition featured innovative custom applications built with Windows development tools. Three of the seven winners, and two of the finalists, used Raima Database Manager to solve their critical application needs.

For professional developers like yourself, Raima products offer:

- **High performance:** unmatched application speed.
- **Portability:** runs on DOS, Windows, OS/2, UNIX, VMS, QNX.
- **Royalty-free distribution:** increase your profits.
- **Source-code availability:** total programming flexibility.
- **Affordable pricing:** starting at just $395.
- **Language support:** ANSI C, C++, and Visual Basic.

Listen to what some of our customers say about our products:

"No other products matched Raima for the price."
James Lisiak, developer, Chevron

"Raima provided us with speed, flexibility, and royalty-free distribution which allowed us to meet and exceed our customers' needs."
Dave Cooper, developer, Atlantic Research Corp.

(subcontractor, Naval Electronic Systems Engineering Activity)

"Database Manager gave us the edge we needed to handle large amounts of data quickly and efficiently within Microsoft Windows."
Kelly Patrick, developer, P&H Fantus

If you're looking for an award-winning application development tool, give us a call. And discover the Raima advantage.

Raima Database Manager  The high-performance DBMS
Raima Object Manager  The object storage class library


1-800-DB-RAIMA  Also available for DOS, OS/2, and UNIX

Circle 127 on Inquiry Card.
Payroll Software for the PC

Version 2.0 of Industrial Strength Payroll automates weekly, biweekly, semimonthly, and monthly payrolls for up to 30,000 employees, who can be hourly, salaried, or 1099 personnel. The software can handle up to 999 companies and mixed payroll frequencies.

Multistate capabilities help companies that operate in more than one state to consolidate reporting. The multistate feature can also accommodate employees who are subject to taxes from more than one state. Industrial Strength Payroll can also process dependent care, excess automobile insurance, and fringe benefits.

Price: $245.
Contact: Phoenix Phive Software Corp., Scottsdale, AZ, (800) 331-1811 or (602) 483-0991; fax (602) 948-1379.
Circle 1299 on Inquiry Card.

Resource Planning

A Unix-based enterprise resource planning system for process manufacturers, ManBase 7.0 combines a client/server architecture, a relational database management system, and fourth-generation-language tool sets. The package includes inventory and production management, sales order management, and full financial capabilities. In addition, you can integrate ManBase with third-party floor-control management systems, electronic data interchange partners, CASE/CIM/CAD tools, and legacy systems.

The modular package lets you build and maintain components and their characteristics for a formula or recipe. With the Master Production Scheduling module, you can view actual and forecasted product demands and determine the dates, times, and quantities for planned orders.

Price: $60,000 and up, depending on configuration, number of modules, and number of users.
Contact: MAI Systems Corp., Novi, MI, (313) 347-9070; fax (313) 347-8958.
Circle 1300 on Inquiry Card.

TimeVision for Mac

The Mac version of the TimeVision personal information management tool gives you 24-hour scheduling at any level of detail with daily, weekly, and monthly windows. You can create multiday events and reliable repeating events over a specified time range.

The PowerEdit feature lets you describe events in an annotation box; designate the begin and end dates, the begin and end times, the type of event, and the frequency; and then set a reminder. With TimeVision's Memo feature, you can create, read, and save ASCII text files; open and read text files you have created in another application; and create a Memo Folder containing business-letter templates or notes from phone conversations. The Note Card file lets you create, sort, and edit an address book, a phone list, or a product catalog.

Price: $99.
Contact: Powercore, Inc., Manteno, IL, (800) 237-4754 or (815) 468-3737; fax (815) 468-3867.
Circle 1301 on Inquiry Card.

PrismaOffice for Windows

PrismaOffice for Windows combines document processing with a database, links to external databases, and E-mail facilities. It includes a 180,000-word spelling checker and a 240,000-entry thesaurus. PrismaOffice for Windows accepts Prisma Language Modules, which let you switch the user interface among major European languages.

The software supports Microsoft's Multiple Document Interface, which lets you open up to nine documents simultaneously. Support for Microsoft's OLE and DDE capabilities lets you link information from other files into PrismaOffice for Windows documents. The software automatically updates documents when you change an original file or file segment.

Price: Stand-alone version, about $600 (£395); three-user network version, about $1360 (£895); each additional user, about $266 (£175).
Contact: Prisma Office, Ltd., Slough, Berkshire, U.K., +44 753 810899; fax +44 753 810903.
Circle 1302 on Inquiry Card.

Successful Negotiations

Negotiator Pro prepares you for all types of negotiations. The package (for the Mac, DOS, Windows, and OS/2) provides a logical and structured way to explore options, reconcile competing interests, and creatively brainstorm.

Negotiation Pro consists of three interactive parts: the Plan, the Hypertext, and the Profile. You use the Plan to tailor question-and-answer structures to your needs. The Hypertext section contains more than 350 terms, 15 international negotiation styles, 50 tactics, legal and business ethics, traditional and cutting-edge theory, and important figures in negotiation. The Profile section asks 11 questions about both sides in a dispute. It then analyzes the parties' negotiation and personality types, predicts the dynamics of the exchange, and advises you on how to approach each side.

Price: $499 to $648.
Circle 1303 on Inquiry Card.
Cool, Quiet, Reliable Power.

STANDARD UNITS
These UL/CSA approved, fully-tested power supplies are the best basic units available.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD 200 XT</td>
<td>$69</td>
</tr>
<tr>
<td>STANDARD 205 SLIM</td>
<td>$89</td>
</tr>
<tr>
<td>STANDARD 220 BABY</td>
<td>$89</td>
</tr>
<tr>
<td>STANDARD 220 AT/TOWER</td>
<td>$89</td>
</tr>
</tbody>
</table>

ULTRA-QUIET UNITS
Unrattle your nerves with a Silencer power supply, recognized since 1986 as the industry's quietest. Cooled with efficient, variable-speed fans that are virtually inaudible! A must for home office or multimedia applications.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SILENCER 205 SLIM</td>
<td>$119</td>
</tr>
<tr>
<td>SILENCER 220 AT/TOWER</td>
<td>$129</td>
</tr>
<tr>
<td>SILENCER 270 AT/TOWER</td>
<td>$179</td>
</tr>
</tbody>
</table>

HIGH-PERFORMANCE UNITS
Upgrade your computer with one of our premium Turbo-Cool power supplies—the choice of PC professionals. You'll get 50% - 100% more power, built-in line conditioning, a dual-stage EMI filter, super-tight regulation, ultra-clean DC output, our high-capacity ThermaSense variable-speed fan (300W models), UL/CSA/TUV approvals, and a no-hassle 2-year warranty! Ideal for high-end workstations and network file servers.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TURBO-COOL 200 XT</td>
<td>$159</td>
</tr>
<tr>
<td>TURBO-COOL 300 SLIM</td>
<td>$169</td>
</tr>
<tr>
<td>TURBO-COOL 300 BABY</td>
<td>$169</td>
</tr>
<tr>
<td>TURBO-COOL 300 AT/TOWER</td>
<td>$189</td>
</tr>
<tr>
<td>TURBO-COOL 450 AT/TOWER</td>
<td>$349</td>
</tr>
</tbody>
</table>

REDUNDANT POWER SYSTEM
Eliminate the risk of costly downtime or data loss due to power supply failure with the TwinPower 900 Redundant Power System. The system consists of two Turbo-Cool 450 power supplies in parallel, utilizing a special power-management interface module. You'll have the reliability of complete power redundancy for the entire network server.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWIN-POWER 900</td>
<td>$995</td>
</tr>
<tr>
<td>W/STANDARD CASE</td>
<td>$1695</td>
</tr>
<tr>
<td>W/INDUSTRIAL CASE</td>
<td>$1995</td>
</tr>
</tbody>
</table>

486 CPU COOLER
It's a fact that 486 chips run hot, often exceeding 185°F! Now, you can reduce the temperature of your 486 processor to a cool, safe 85° - 95°F with our CPU-Cool. You'll prevent random system errors and add years to the life of your valuable CPU. Consists of an ultra-quiet mini-fan embedded in a sculptured heat sink that easily mounts on the CPU. Powered by a spare drive connector. Effective, inexpensive insurance!

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU-COOL</td>
<td>$39</td>
</tr>
</tbody>
</table>

INTERNAL ON-LINE UPS
Protect your PC and its data from power surges, sags, and outages with our UL-approved InnerSource, a combined AT/Tower power supply and On-Line UPS. Its auto-recharge battery provides up to 15 minutes of backup power for both your PC and monitor. This reliable, integrated protection costs less than an equivalent 550VA external UPS, and it saves space too! A Novell interface is available.

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>INNERSOURCE AT/TOWER</td>
<td>$349</td>
</tr>
</tbody>
</table>
BYTE introduces Your Direct Link – An enhanced service for BYTE readers that gives you free information on products – faster and easier!

In the NEW Direct Link section, here’s what you’ll find:

- Alphabetical Index to Advertisers Including Phone Numbers
  Now dial companies directly.

- Product Category Index to Advertisers
  Order information on individual products or complete product categories.

- Redesigned Editorial Index
  Free information from companies covered in articles, columns, or news stories.

New Enhanced Direct Link Card
Receive free information quickly by filling out and mailing or faxing Your Direct Link Card today!

Send for FREE product information by filling out Your Direct Link Card found in the back of every issue.

Buy It Through BYTE!
"I couldn't find a powerful CASE tool that was affordable. So I designed one."

JAN POPKIN, CHIEF SCIENTIST
POPKIN SOFTWARE & SYSTEMS, INC.

"I'm an engineer. And I know what it's like to need a high-performance and easy-to-use CASE tool. One that I could afford to place on every project team member's desk, not just a select few. That's why I developed System Architect."

As Chief Scientist at Popkin Software, my role is to bring the real-world experiences of our developers to bear on the design and implementation of the best CASE tool possible. System Architect is the result.

It's also the result of listening to our more than 10,000 users. We take your advice because we know it's real. Then we incorporate it and feed it back to you in real-world solutions and new product innovations."

Low Price.
High Performance.

Since its introduction in 1988, System Architect (SA) has proven that many of the features offered by more expensive CASE tools are available for a fraction of the cost. There are now more than 10,000 SA copies in use at 2,500 installations worldwide.

Quick and Easy.

System Architect works on IBM® and IBM-compatible PCs running MS Windows® and OS/2 PM®. It comes with a complete data dictionary that users can customize to meet their needs. Project personnel can easily share information both on and off a network. It's so easy to use that even from the first day you can sit down, get to work, and produce results.

Multiple Choice.

System Architect works with multiple methodologies: Yourdon/DeMarco, Gane & Sarson, Ward & Mellor (real-time), Booch, Shlaer/Mellor (OO), Coad/Yourdon, Information Engineering and SSADM. And diagram types and charts including: DFDs, Entity Relation diagrams, Decomposition diagrams, State Transition diagrams, Structure Charts, and Flow Charts.

The Power To Grow.

To respond to advances in technology such as Client/Server Architecture, SA continues to grow in functionality and productivity. A few optional modules now offered are:

SA Schema Generator: Translates entity models from the encyclopedia into entity models from the encyclopedia into schema for DB2, Oracle, Ingres, SQL Server, Rdb, PROGRESS, Paradox, SQL Base, AS/400, (SQL & DDS), Interbase, OS/2 DBMS, dBASE III, XDB, SYBASE, and Informix. Generates Windows DLGs, and C type data definitions or COBOL data structures.

SA Screen Painter: Develops screens for GUI or character-based applications, which are automatically populated from your SA Data Dictionary/Encyclopedia; generates MS Windows dialogs and Microsoft or Microfocus COBOL Screen Sections.

SA Object Oriented Analysis & Design (OOA/OOD): Supports Booch 91 and Coad/Yourdon.

SA Network Version: Diagram and data dictionary record locking allows multiple project members to work concurrently on the same project.

Built for Engineers.

SA also has other advantageous features: automated documentation; extensible data dictionary; normalization, rules and balancing requirements traceability; import/export; custom reporting; and CRUD Matrices.

Call us toll-free today at 800-REAL-CASE, x109.

To find out how to qualify for your free 30-day evaluation copy, simply call us today or fax us at 212-571-3436.

SYSTEM ARCHITECT

Popkin Software & Systems, Inc.,
11 Park Place, New York, NY 10007

©1992 Popkin Software & Systems, Inc. All other brand names and product names are trademarks or registered trademarks of their respective holders. Specifications subject to change at the sole discretion of the company.
**Create Presentations**

With Passport Producer and your Mac, you can easily integrate and synchronize animation, digital video, sound, music, and presentation graphics. This multimedia presentation-software package lets you add sound tracks to QuickTime movies and animations and accurately synchronize to MIDI or digital audio using the Cue Sheet feature.

The Cue Sheet displays all tracks and time locations, so you can see the events or cues in a visual form as they relate to each other in time. You can align multiple cues for simultaneous playback and print out the Cue Sheet to use in a paper edit, to review with clients, or to aid in storyboarding. Passport Producer lets you import cues in TEXT, PICT, PICS, or QuickTime file formats.

Passport Producer displays the final presentation on a user-customized stage. You can position visual elements and arrange multiple objects on the stage in an unlimited number of ways. The package also lets you display presentations on two or more monitors simultaneously.

**Movie Clips on CD-ROM**

The Action CD-ROM comes with clips for QuickTime for Windows, complete with Apple Computer's Movie Player for Windows, QuickTime DLLs, and Windows Picture Viewer. You can play Action's four categories of movie clips from the CD-ROM or copy them to your hard drive.

Movie categories include historical, modern, music video, and sound-only movies. Also included are 3-minute segments of MTV-style music videos. The Action CD-ROM also contains high-quality pictures that you can display, zoom, and scroll using the Picture Viewer.

**Sound and Music for Windows**

The AudioView package contains three applications for Windows that let you control the digital-audio and CD-ROM functions of PC sound cards and multimedia PCs. The applications are AudioView, the Voyetra Audio Mixer for Windows 3.0, and the Voyetra CD Player.

The AudioView digital-audio editor records, edits, and plays music, narration, or sound effects as digital-audio files stored on your computer's hard drive. The file display window gives you a graphical view of the entire file or lets you zoom in for a closer look—as close as a single sample.

With the Voyetra Audio Mixer, you can control the volume levels of most types of sound. You can preset levels before recording or playing, or mix them during operation for perfectly balanced sound tracks.

The Voyetra CD Player helps you name and catalog disks to facilitate locating and playing a CD track. The Playlist feature lets you assemble and play a series of CD audio tracks in any order. Or, you can let the CD Player's Shuffle feature play tracks in random order.

**Sound-Editing Software**

Digital Soup Sound Professional lets you edit and mix as many as 16 tracks of imported sound files or sounds recorded from a CD-ROM, microphone, or other player device that can interface with your sound board. The editor offers functions such as cut, paste, copy, and delete, and imports and exports standard Windows audio files. It is an OLE server.

You can choose various sound effects, including fade-in, fade-out, modulate, compress, reverse, repeat, and delay. You can also view and modify the frequency content of your sound with Digital Soup's 3D Spectral Analysis and its four-band parametric equalizer.

**Entry-Level Multimedia**

Now non-technical users can enter the world of multimedia with UCM's MM Box 2 multimedia production software package. The package lets you bring together analog and digital video, graphics, images, 2-D and 3-D animation, and stereo sound.

Two versions of MM Box 2 are available: a 3 1/2-inch floppy disk version and a CD-ROM version. The CD-ROM version includes 125 animations; an Image Photo Library containing 250 BMP digitized images and 750 thumbnail images; 25 minutes of original music; 45 sound effects; and MM Browser software, which lets you search through the elements.

**Contact:** UCM, Ltd., Hove, East Sussex, U.K., +44 273 208103; fax +44 273 774064.

**Circle 1307 on Inquiry Card.**
IMAGINE BROWSEING THROUGH THE LIBRARY OF CONGRESS AT 1500 MPH.

That's how quick the world's fastest CD-ROM drive moves you through volumes of information.

The new Pioneer DRM-604X Minichanger is TWICE AS FAST as any drive on the market. It has a data transfer rate FOUR TIMES the normal speed. And it holds SIX discs at once — more than any other drive.

High speed data transfer rate is an astounding 600 KBytes/sec. High speed access time averages 300 msec. Change time between discs has been reduced from seven to five seconds.

If six discs are not enough, you can daisy-chain up to seven Minichangers from a single controller, giving access to 42 discs — more than 5 million pages of data.

The greatest amount of information at the greatest speed. It makes so much sense, it's hard to imagine why anyone would even consider any other drive.

For more information, call 1-800-LASER-ON today.

Or write to Pioneer Communications of America, Inc., Optical Memory Systems Division, 3255-1 Scott Blvd., Suite 103, Santa Clara, CA 95054.

THE PIONEER HIGH SPEED CD-ROM MINICHANGER

Pioneer DRM-604X is a trademark of Pioneer Communications of America, Inc.

Circle 123 on Inquiry Card.
Geometry Solver for Pen PCs

Now you can use your pen-based computer as a geometry collection station with Saltire Software’s SketchRight. You sketch in the geometry and enter the distances or angles you want to measure. SketchRight gives you an accurate to-scale representation and then calculates unknown distances, angles, and areas measured from the scale drawing.

SketchRight also includes two-way DXF links, which let you communicate with most standard CAD packages, and two-way DDE communication and Clipboard support, which lets you communicate with other Windows for PEns applications.

Price: $249.
Contact: Saltire Software, Inc., Beaverton, OR, (503) 622-4055; fax (503) 622-4537.
Circle 1310 on Inquiry Card.

Windows File Utility

Systems Compatibility has added to Outside In 2.0 for Windows support for graphics and compressed files, file management, and the ability to integrate the software into Windows E-mail programs to view attachments. You can use the file-viewing and data-import utility with E-mail programs, word processors, and BBS files, or anytime you need to look at a file.

The package lets you view files from more than 90 DOS, Windows, Mac formats; launch applications from a file view; copy data to the Clipboard for use in other Windows programs; combine data from word processors, spreadsheets, and databases; and search across directories, drives, and networks by filename, file type, file extension, or text string. The Tear-Off feature lets you view multiple files at one time, and the Text Search feature lets you search a document or file list for specific words or phrases.

Outside In recognizes and displays more than 120 file types from DOS, Windows, Mac, DEC, and Wang programs and lets you paste graphics, text, spreadsheet, or database files from DOS, Windows, and Mac programs into the mail edit window. It also integrates directly with cc:Mail, Microsoft Mail, WordPerfect Office, and Da Vinci eMail.

Price: $89.
Contact: Systems Compatibility Corp., Chicago, IL, (800) 333-1395 or (312) 329-0700; fax (312) 670-0820.
Circle 1311 on Inquiry Card.

Protect Your Unix System

Woodside Technologies’ Fortress package is a GUI-based security program with antivirus protection for Unix. Using a point-and-click interface, the program provides Unix users and system administrators with four security modules that run from a central menu. The security modules include the Trojan Horse Detector, the Worm-Proofer, the File Inoculator, and the Password Cracker.

The Trojan Horse Detector searches the user’s path, the entire system, or any system portion you specify to locate duplicate copies of common Unix commands. The Worm-Proofer detects and eliminates weak-security entry points that might allow unwanted programs to log onto a remote system through network connections and replicate themselves.

The File Inoculator searches files and adds a unique fingerprint in an encrypted format without changing the files. The fingerprints are stored in a secure database, which automatically scans files at user-specified time intervals. The Password Cracker module attempts to crack all passwords to ensure that those that are easy to guess do not threaten the security of the system.

Price: $495.
Contact: Woodside Technologies, Inc., Sunnyvale, CA, (408) 733-9503; fax (408) 732-7335.
Circle 1312 on Inquiry Card.

Turn Your Mac into a Dictaphone

With the Useful Voice Processor, you can turn your sound-capable Mac into a fully functional dictation machine. In environments where typing or mousing is not appropriate, this software-only product lets you dictate a letter, compress it, and store it on disk with one-finger operation.

The package uses Apple’s MACE (Macintosh Audio Compression and Expansion) technology to compress the sound as you record it, and a proprietary silence elimination algorithm automatically cuts out the pauses when you speak. A transcription function lets you type text while the program is playing back the recorded sound. The Useful Voice Processor stores the transcription in a separate document from the audio, and it is fully compatible with most word processors.

Price: $179.95.
Contact: Useful Software Corp., Beverly Farms, MA, (508) 922-7272; fax (508) 922-0413.
Circle 1313 on Inquiry Card.

SPREAD THE WORD

Please address new product information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please include a product description, price, ship date, and an address and telephone number.
Only NRI at-home training gives you real-world programming skills in three in-demand languages: QBASIC, C, and Visual Basic, today's hot new language designed for writing popular Windows applications. Best of all, you get hands-on training with a powerful new 486sx-based computer system, complete with 80 meg hard drive, Windows, and professional programming software you keep!

▶ NRI, the recognized leader in at-home computer training, shows you how to take advantage of today's newest programming opportunities

Get in on the ground floor of one of today's fastest-growing career fields: computer programming. The Bureau of Labor Statistics forecasts that job opportunities for programmers will increase much faster than average over the next 10 years, with as many as 400,000 new jobs opening up by 2005.

And the fastest-growing segment of programming jobs will be PC programming, fueled by the phenomenal popularity of Windows, the efficient power of C, and the ascent of exciting new languages like QBASIC and Visual Basic.

Now, with NRI at-home training, you can get the new skills you need to build a top-paying career — even a full- or part-time business of your own — in this high-growth, high-opportunity field. employers and clients demand... including programs designed for use in a Windows environment!

Only NRI gives you first-hand programming experience with a state-of-the-art 486sx mini-tower computer system, complete with hard disk drive, a full megabyte of RAM, high-density floppy drive, mouse, monitor, and more — all yours to train with and keep!

Plus, you explore the extraordinary capabilities of three in-demand programming languages. You learn to design, code, run, debug, and document programs in QBASIC, C, and Visual Basic. Best of all, since Visual Basic is specifically designed for creating Windows applications, you learn to generate fully functioning Windows programs, complete with text boxes, command buttons, and other sophisticated graphical interface elements.

▶ No previous experience necessary

Train with NRI, and immediately start getting the money-making job skills you need to be a computer programmer — no matter what your previous background.

NRI's step-by-step lessons and hands-on programming projects help you master the programming concepts used every day by successful PC programmers. With your experienced NRI instructor on call and ready to help, you go on to learn programming in three of today's hottest languages.

By the time you complete your course, you have a clear understanding of programming methods, languages, and techniques...and you're ready to handle any programming task with confidence.

See other side for highlights of your NRI hands-on training in computer programming

SEND CARD TODAY FOR FREE NRI CATALOG!

NRI Schools
McGraw-Hill Continuing Education Center
4401 Connecticut Avenue, NW, Washington, DC 20008

YES! Send me the FREE catalog I've checked and show me how NRI can give me the skills and confidence to earn good money in an exciting new career or business of my own.

✓ Check one free catalog only

Computer Programming
PC Applications Specialist
Programming in C++ with Windows

Other Computer Career Opportunities
Microcomputer Servicing
Desktop Publishing
Bookkeeping and Accounting
Computer-Aided Drafting

Name (please print) Age
Address
City State Zip

Accredited Member, National Home Study Council
5448-0293
Learn computer programming as you train with the latest programming tools... a 486sx-based computer system, Windows, Visual Basic, and more!

“I couldn’t believe NRI gives you a computer, loads of reference material, and professional software. The course has taken my knowledge of computers and my self-confidence to new levels!”

Rob A. Chappa, NRI Student

Here’s what makes your 486sx mini-tower computer system the ideal programming tool:

- Full IBM PC/AT-compatibility
- High-speed 80486sx CPU with 25 MHz clock
- 80 megabyte hard disk drive
- 1 meg RAM (expandable on board); 64K ROM
- Windows graphical interface
- 14" high-resolution monitor with tilt-swivel base
- 1.2 meg, high-density 5½" floppy disk drive
- MS-DOS operating system with QBASIC Interpreter
- Professional compilers for programming in C and Visual Basic

Now, as never before, you can succeed as a computer programmer

NRI at-home training gives you everything you need to build a high-paying career as a computer programmer. Designed around a state-of-the-art 486sx computer system, your training guides you smoothly from fundamental principles through coding in three of today’s most widely used computer languages: QBASIC, C, and Visual Basic, the language designed specifically for programming in a Windows environment.

With NRI, you get the hands-on experience and the confidence it takes to master today’s programming challenges. And, by creating and running your own full-length programs, you build skills you’ll be proud to show any prospective employer or client.

Send today for your FREE catalog

Prepare now for a high-paying career as a computer programmer! See how NRI at-home training in Computer Programming gives you the experience and the know-how, the computer and the software you need to get a fast start in this top-growth field. Send today for your FREE catalog.

If the card is missing, write to us at NRI Schools, McGraw-Hill Continuing Education Center, 4401 Connecticut Avenue, NW, Washington, DC 20008.

IBM PC/AT is a registered trademark of the IBM Corporation. Windows, QBASIC, and Visual Basic are trademarks of Microsoft Corporation.
hey’re doing it to us again. Back in the early 1980s, the first big boom in small computers was stalled when the U.S. government created a cartel to force the Asian suppliers to charge us a lot more for memory; that, in turn, drove up the price of cheap clones, with the result that we all paid more for our machines. Unfortunately, it’s happening again: government actions are driving memory costs up. This means fewer computers will be sold, meaning less software sold, meaning a slowdown in our industry’s growth. So it goes.

Bits Ain’t Bits

Windows likes a large amount of memory. It’s true enough that you can run Windows with 4 MB, and I do that on my laptops; but when I’m home, I like to have a lot of windows open at once. Typically I’ll have Norton Commander, Franklin Ascend, Q&A, Q&A Write with Word Finder and the Definitions Plus American Heritage Dictionary, Word for Windows, a CD-ROM window, and probably a communications program open at all times.

From time to time, I bring in other stuff, like word processor format converters, accounting and bookkeeping systems, and new programs I’m trying out for the column. Add all those up, and 8 MB isn’t too much. Bring in a programming language—Visual Basic or Borland Pascal in my case—and a drawing program for doing maps for my stories, and it strains that 8 MB to the limit.

Indeed, at 8 MB I ran out of resources often enough that I decided my primary system ought to have 16 MB. That caused a minor problem most people wouldn’t have: what is my main system? What makes this column different is that I use the stuff I write about, so unless I’m going to write about one machine and one only, I have to keep swapping systems around. That’s part of the fun, of course, but it also means that I needed more memory for several machines, not just one. Still, I thought, memory is cheap. I ordered 20 MB, which I figured would cost under $1000. My intent was to put it in my various machines, and when it was time to send those machines back, I’d just take my SIMMs out and use them again in whatever new systems replaced them.

Wrong on two counts.

First, memory used to be cheap; but then my government helped me by threatening high tariffs on Korean imported memory. The price of memory just about doubled in a week, and as I write this, it doesn’t look like it’s coming down soon. I suppose it shouldn’t surprise me. Every time the clone makers have threatened the big companies in clone wars, the government has intervened to keep computer prices high; why not this time? Of course, that plus the FCC regulations kills off U.S. startups before they’re born while helping overseas competitors, but so it goes. Anyway, my 20 MB cost considerably more than I’d intended.

Second, memory for one system may not work in another. Example: I have two Gateway 2000 systems. We love them. One is a 486DX2/50, and the other is a 4DX2-66V. The 486DX2/50 uses conventional SIMMs, and Alex quickly upgraded it to a 20-MB system. The 4DX2-66V, on the other hand, uses an entirely different configuration, one Alex and Barry Workman had never seen before, and I’ll have to get memory for that one directly from Gateway (they sell it at reasonable prices). Meanwhile, I find, my Cheetah 486/33 uses yet another memory form factor, and that was even trickier to find.

The result is I have some expensive memory I can’t use. It’s not a disaster. I can always find places to put memory—caching drive controller boards, older systems I’ve donated to schools—but it is annoying, and the moral of the story is, memory isn’t standard, and what looks like a bargain may turn out not to work in your machine. Pournelle’s law: if you don’t know what you’re doing, talk to dealers who do. I didn’t, and I should have.

This Time for Sure

Every year we hear that this will be the Year of the LAN. What with Microsoft pumping millions into advertising Windows for Workgroups, and every other LAN maker jumping onto the network bandwagon, this may really be it. Anyway, after several false starts, 1993 certainly is
the Year of the LAN for Chaos Manor.

The question is, which LAN?

It's not a simple question, and worse, it can't easily be broken into the simpler questions of hardware and software, because the hardware you choose limits what software you can run; the software you like today may not be what you need tomorrow; and neither software nor hardware is all that cheap.

You have to start somewhere, so I figured I'd start with what looked like the simplest possible LAN: two machines linked by Windows for Workgroups.

Ohmmmm, Ohmmmmm

LANs are standard in businesses large enough to afford an information services manager or networking guru, but they haven't caught on with small businesses and home establishments. One reason is their complexity; and part of that complexity is the choice of networking hardware. Do you use ARCnet, Ethernet, Token Ring, or perhaps LANtastic nine-pin twisted pair? Whose Ethernet? Thinwire, thickwire, or twisted-pair Ethernet? Intel boards? Artisoft LANtastic boards? Thomas-Conrad 10Base-T? I had every one of those. Now what?

First things first. Since I intended to hook up Windows for Workgroups (henceforth WFWG), it made sense to use the EtherExpress 16 boards Intel sent at Microsoft's request. This is what will be bundled into the WFWG Starter Kits Microsoft will be aggressively marketing about the time you read this; and since the boards are software configured—no jumpers or DIP switches to set—I figured it would be the simplest way to start.

The instructions were simple enough. First open two computers and install the boards, and then run the Intel Setup program to configure and test them. That turned out to be as easy as it sounds, and I was done in under an hour. Now to connect the two machines.

Unfortunately, while I'm sure that when Microsoft actually ships WFWG Starter Kits they'll include cables and instructions for connecting them, I'm working with late beta versions; and what I got was a box of boards, some disks, and very minimal instructions. The boards have two connectors on the back: a DB-15 (the same size and shape as a game port) and a BNC coaxial cable connector. There is also a version of the Intel EtherExpress board that has an RJ-45—it looks like a big telephone jack—in place of the BNC.

The DB-15 is for thickwire Ethernet and won't concern us. The big phone jack is for twisted pair, which will probably be what I want for a permanent installation, and I'll get back to that in a bit. For the moment, what I needed was the BNC: thin wire, sometimes known as cheapernet.

This takes 50-ohm cable, designated RG-58. You can buy RG-58 cable in bulk and add your own connectors. If you choose to do it that way, good luck: faulty cable connectors are the most common cause of network problems. I didn't take that chance. RG-58 with connectors installed is available in various lengths at most electronics stores, including Radio Shack. At Radio Shack, for some reason it's known as 51-ohm cable, but it's the genuine article and works quite well.

Setting Up

I had the boards installed and had run Soft- set to configure them in the two machines I'd selected for the tests: Cheetah 386/25 and Cheetah 486/25. The 386/25, incidentally, began life as a 386/15. When Intel developed the faster 386/25 and 387/25 chips, I wangled one of the first sets they let out of the company; it's thus one of the oldest 386/25 machines in existence. That Cheetah served as my main machine until it was replaced by a 486. I figure to load it up with assets like the Pioneer DRM-604X Minichanger CD-ROM drive and a big optical drive, connect it to the Kyocera Ecosys laser printer, and let it be a network file server. Anyway, now that I had the boards installed and configured, I connected the two machines with a Radio Shack RG-58 cable.

WFWG can install as an upgrade to an existing Windows setup, and that's the way most will use it, but just to be on the safe side, I deleted all traces of Windows on both machines and started from scratch. As usual, I had some minor problems with the Setup program: possibly the 3½-inch drive on the Cheetah 386/25 is a little out of line, because at Disk 5 Setup simply refused to recognize that this was Disk 5. Eventually I convinced it.

When you install WFWG, you give each machine a name; in addition, you must name the workgroup you want to join. Once that's done, WFWG looks just like Windows 3.1, except there's a tool bar across the top of File Manager, a Network icon in the control panel, and a couple of interesting new icons in the Accessories group.

The icons do about what you expect them to; that is, click on the Network icon, and it will log you into the network. In the File Manager tool bar, there's an icon of a hand holding out a folder: click on that, and you can specify which files, file directories, or disk drives you want to make available across the network.

The network configuration was simple
Every time JCPenney sells a pair of jeans, a toaster or a bottle of perfume, MINUTEMAN takes charge. That's because more than one thousand JCPenney stores rely on MINUTEMAN UPS systems to back up power to their point-of-sale systems.

Every day your company relies on its voice and data communications equipment to stay productive. Unfortunately, the electricity that powers these vital systems is not reliable. Blackouts, brownouts, spikes, surges and even lightning strikes are common in most business environments. And the high cost of losing vital information and productivity due to power outages and surges calls for preventive measures.

Power requirements can be confusing. And your company has unique needs that often require custom solutions.

MINUTEMAN PRODUCTS:
- On-line and standby UPS 300VA to 10KVA
- Shutdown software for every available operating system
- Automatic voltage regulators
- Surge suppressors
- International models
- Two year warranty

Reduced prices up to 36%

Call for complete price list.
and intuitive. There was one problem: I couldn’t access anything across the net-
work.

Terminate with Prejudice
All this was late at night, with this column due. Since the WFWG software seemed to be working just fine, I figured the problem was hardware; so the first thing was to exit Windows and run the Softset diagnostic programs. Unfortunately, I couldn’t do that. Softset works only if you disable all network drivers and reboot. Well, all right, go into CONFIG.SYS and REM out all the device drivers WFWG had installed—there were several—and then reboot and try Softset again.

The diagnostics had three options: test the board, test the network, and turn this board into a network responder to allow testing from another station on the network. That seemed simple enough. Test the board. Fine. Test the network: nothing responding, and after a while it said I should check the cable. Fine. Go to the other machine, disable all network device drivers, reboot, run Softset, test the card—it’s fine—and configure that as a network responder.

Alas, no joy. Check the cable. Use an ohmmeter to check continuity. Seems OK to me. Reconnect. Still nothing. I ground my teeth, wrote some other stuff for the column, and went to bed.

At this point, experienced Ethernet users are laughing their heads off, so I’ll finish this story quickly. I got on-line to BIX and asked for help; within an hour, Jeff Slo-
man sent a note asking if I had properly terminated my Ethernet cables. Since I had no idea what termination meant, clearly I hadn’t; time to call Barry Workman for some elementary instructions.

Ethernet thin-wire systems connect in a daisy chain, each machine connected to the next, so what connects to the board in each machine is a T connector. Since I had only two machines in this loop, I hadn’t known that I needed to connect them using T connectors, but that was the trouble. At each end of a thin-wire Ethernet system, there must be T connectors, with a little metal 50-ohm terminator cap on one branch of the T. Moreover, not all terminator caps are 50 ohms: ARCnet termina-
ators are 96 ohms, and there are other values. In theory, the 50-ohm connectors are color-coded green, but in fact many are bare metal.

Once I knew what to do, it was all pretty simple. I found a pair of T connectors and terminators that had come with Arti-
soft’s Ethernet Starter Kit, tested with a multimeter to see that they were in fact 50 ohms, and connected the machines properly. When I ran the Softset network di-
agnostics everything was just fine, so I edited the CONFIG.SYS files to put the device drivers back in, rebooted, started up Windows, and—voila!

Well, not quite, because I hadn’t un-REmed all the relevant statements in CONFIG.SYS and AUTOEXEC.BAT on both machines, but when that was done, all was well. I could share and transfer files and programs, examine schedules, and generally do networkish things, all in a very natural manner.

The bottom line is that if you connect the hardware properly, setting up a WFWG LAN really is as simple as adding the boards and running the software. I sure wish I’d done it that way.

Adding to the Network
My next step was to move the T connector with terminators from the 386/25 to my main machine, the Cheetah 486/33, putting a simple T connector on the 386/25; this
From Your Friends In The Business...

Thank you for making 1992 the best year yet for everyone at Gateway 2000. Because of your belief in us, we captured an unprecedented five Computer Shopper 1992 Best Buy Awards including Best Overall Vendor.

And in PC Computing’s 1992 MVP Awards, Gateway was honored with the MVP Desktop System Award for our 4DX2-66V system. Thank you PC Computing!

We’re much obliged to PC Magazine’s readers who gave us the best overall score in PC Mag’s 1992 Service and Reliability Survey.

Our humble thanks to the readers of PC World. They honored us with two World Class Awards in 1992 – one for the Gateway 4DX-33 and another for Service and Support.

Our hats are off to Compute magazine for presenting us with 1992 Best Desktop Computer for the Gateway 4DX2-50.

We’re thrilled that Popular Science magazine recognized the Gateway HandBook portable PC as one of 1992’s “Best of What’s New.”

And thank you BYTE magazine for an Award of Distinction for the HandBook. BYTE readers also chose the Gateway 486DX as Desktop Computer of the Year.

Finally, we applaud all our loyal customers. Without your unwavering support throughout the years, Gateway couldn’t have won these honors. We owe our success to you, and we’ll be forever grateful. Here’s to another great year in 1993!
A Message To Our Subscribers

From time to time we make the BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE Magazine
Attn: Subscriber Service
P.O. Box 555, Hightstown, NJ 08520

USER'S COLUMN

gave me a daisy chain from the 486/33 to the 386/25 to the 486/25. Then I upgraded Windows 3.1 to WFWG and logged onto the network—and this time everything really did go as smoothly as all that, no problems whatever.

Flash: I’ve now seen the shipping version of the Microsoft WFWG Starter Kit. It includes instructions, a video, the cables and T-connectors and terminators, and even a screwdriver: about as complete and easy-to-use a kit as I have ever seen. If I’d had this, I wouldn’t have had any problem at all.

Thin-Wire Blues

Since thin wire works so well and installs so easily (once you know how to terminate each end), why consider anything else?

The problem is that thin wire can be daisy chained only in a bus topology; and if any machine is disconnected from the network, whether deliberately or because of a bad cable, the whole network dies. Moreover, there’s a long history of thin-wire cable problems, particularly if you make the cables yourself.

The alternative is twisted pair, which you’ll remember has RJ-45 connectors that look like oversize telephone jacks and which connects with cables much like telephone cable. The advantage of twisted pair (otherwise known as Ethernet TP and officially as 10Base-T) is that you configure the system as a star (also known as home run): every cable goes to one central point, where they are all connected together. As long as any two machines are still connected to the network, you can transfer files between them. You can also have bridges from one star to another.

The disadvantage is that each star hub must have a concentrator into which all the 10Base-T lines run. The concentrator can be a stand-alone box or a board installed in a computer that you’ll use as a network server; that board will also serve as the network card for the server machine. Concentrators can also accept thin wire as well as twisted pair. Concentrator costs vary, but they generally run around $500 to $1000, depending on the number of ports you need.

I’ll have more on this another time. The goal here at Chaos Manor is to have twisted-pair lines run from nearly every room to a central concentrator box in the telephone closet. Note that a stand-alone concentrator need not be located near any computer at all; the network server is just another line into the concentrator if you use that scheme. Anyway, that’s what we mean to end up with, and you’ll get progress reports as I go. continued
The only Windows™ statistics package you’ll ever need.

#1 for DOS and Windows
Rated “the best general-purpose statistics program” for the PC by Software Digest®, SYSTAT for DOS is now joined by SYSTAT for Windows. This addition to the SYSTAT family takes full advantage of Windows, with pull down menus, dialog boxes, sizable windows, and the ease of use you expect in a Windows package.

SYSTAT for Windows runs in standard and 386 enhanced modes and can take advantage of Windows advanced memory management. No matter how large or complex your analysis is, you can use SYSTAT.

SYSTAT delivers a balance of power and simplicity. It lets you analyze and manipulate data with a comprehensive range of advanced statistical procedures, and present your results with stunning graphics.

Just point and click
SYSTAT is a full-fledged Windows application. Just point and click. SYSTAT’s QuickStat™ buttons give you simple, single-click shortcuts to common statistical analyses.

More statistics, from the basic to the most sophisticated
A full range of univariate and multivariate statistics—from t tests to multidimensional scaling. With a few clicks you can turn most statistics into graphs and perform:
- multiway crosstabs with log linear modeling
- nonparametric statistics
- principal components and factor analysis
- cluster analysis
- time series
- nonlinear estimation
- correlation matrices
- means, effect, and dummy models
- post hoc tests

SYSTAT offers the most advanced multivariate general linear model available for Windows.

The most graphics
No other statistical or graphics package can produce all the scientific and technical graphs that SYSTAT can—nor surpass its ease of use. Graphics capabilities include:
- histograms
- single, multiple, stacked, and range bar graphs
- single and grouped box plots
- stem-and-leaf diagrams
- pie charts
- scatterplot matrices
- 3-D data and function plots
- contour plots
- control charts
- maps with geographic projections
- Chernoff faces
- complete color spectrum
- log and power scales
- confidence intervals and ellipses
- linear, quadratic, step, spline, polynomial, LOWESS, exponential, and log smoothing

A compatible family of products
Whichever you choose—SYSTAT for Windows, SYSTAT for DOS or both—you’ll enjoy the most powerful statistics and scientific graphics software available for the PC.

For more information, special offers for current users, and demo disks, call:

708-864-5670
For Windows circle 138,
For IBM/DOS circle 139.

For more information call or write: SYSTAT, Inc., 1800 Sherman Avenue, Evanston, Illinois 60201-3793. Tel: 708.864.5670, Fax: 708.482.3567

The LANtastic Alternative

One alternative to WFWG is Artisoft's LANtastic for Windows. I'll be comparing WFWG and LANtastic in the next few columns. Each has strong points.

Whether you use LANtastic or WFWG, you should strongly consider getting cards that have both thin-wire and 10Base-T interfaces. LANtastic's boards have all three: thin wire, twisted pair, and the DB-15 thick wire (which few places use now). Thin wire is easily set up, and you can lay the lines on the floor for testing the system. Once you know where you want lines, it's cheaper to have 10Base-T cable pulled through the walls. As your LAN grows, you'll find that cabling costs aren't trivial.

Finally, if you connect up your WFWG with LANtastic boards, you can set up software controls to run your system with WFWG, LANtastic for DOS, and LANtastic for Windows. (You cannot run LANtastic and WFWG simultaneously; it's one or the other, but never both.) For that matter, you can install just about any network software known, including full-blown NetWare 3.x, with LANtastic cards.

That kind of flexibility is worth having. However, fair warning: installing LANtastic boards is not as simple as installing the Intel EtherExpress 16. There are jumpers to select I/O addressing, IRQs (interrupt requests), and other such matters. The manuals, while complete, tend to assume knowledge of things you may not know. While Softset goes out and looks at what's happening in your system, chooses the proper settings, and configures the board, in all software, LANtastic boards require you to use some program like WinSleuth or Checkit to be sure there are no addressing and IRQ conflicts. (Another way is to cheat: install an Intel board, run Softset, write down the settings Softset recommends for the Intel board, and set the LANtastic board up that way.)

In a word: setting up with LANtastic boards will give you a considerably more flexible system, but you'll have more trouble getting it running. Clearly, it's not that much trouble: Artisoft is now one of the largest suppliers of Ethernet boards in the country.

Finally, if you do get the Microsoft/Intel Starter Kit and go with thin wire, you haven't locked yourself out of using LANtastic later on; LANtastic will run with the Intel boards.

And that's enough on networks for this month. More next time; indeed, networking will be a major theme all year.

Hypertext Help

There's no excuse for releasing Windows products without adequate help files. By adequate, I mean well indexed, with index entries for the operations your customers will want to perform and with live cross-references, otherwise known as hypertext. If you include a glossary (and in most cases you should), that ought to be linked in so that you can get pop-up definitions of terms from inside the help screen rather than have to go look things up.

All that and more can be done by using Docto-Help from WexTech Systems. Docto-Help requires Word for Windows 2.0 (and Windows 3.x itself, of course). What you get is a system for converting Word for Windows documents into indexed hypertext documents, using those to build help files and compiling the help files so they'll work in Windows. The package includes the Microsoft Help Compiler, but fortunately you don't need to know much about how that works.

The indexing capability is limited and a

DATA COMPRESSION LIBRARIES™

PKWARE's® Data Compression Libraries™ allow software developers to add data compression technology to software applications. The application program controls all the input and output of data allowing data to be compressed or extracted to or from any device or area of memory.

• All Purpose Data Compression Algorithm Compresses Ascii or Binary Data Quickly with similar compression achieved by the popular PKZIP software, however the format used by the compression routine is completely generic and not specific to the PKZIP file format.
• Application Controlled I/O and memory allocation for extreme flexibility.
• Adjustable Dictionary Size allows software to be fine tuned for Maximum Size or Speed.
• Approximately 35K memory needed for Compression, 12K memory needed for Extraction.
• Compatible with most popular Languages: C, C++, Pascal, Assembly, Basic, Clipper, Etc.
• Works with any 80x86 family CPU in real or protected mode. $295.00
• No runtime royalties.

RUNNING OUT OF EXPENSIVE DISK SPACE?

PKZIP can help! PKZIP compresses your files to free up disk space and reduce modem transfer time. You can compress a single file or entire directory structures with a single command. Compressed files can be quickly returned to their normal size with PKUNZIP.

Software developers can reduce the number of diskettes needed to distribute their product by using PKZIP. Call for Distribution License information.

The included PKZIP utility lets you store compressed files as a single self-extracting .EXE files that automatically uncompressed when run. Only $47.00
The Nanao FlexScan® family of award-winning big-screen monitors introduces our newest family member. The FlexScan F340iW — an affordable monitor for Windows applications.

Our new 35lb., 15" addition has the same traits as its big brothers. Features like our exclusive Advanced Image Control System that lets you adjust color balance, store picture adjustments and recall the settings...automatically. And a flat-square, .28mm dot pitch Invar Shadow Mask CRT combined with Dynamic Beam Spot Control to optimize both resolution and convergence over the entire screen. You get a brilliant, sharp image and 20% more work area than a 14" monitor, plus 1024 x 768 resolution at a 76Hz flicker-free refresh rate, up-front controls and compliance to MPR-II guidelines — all of which make the F340iW a healthy addition to any work environment.

So, if you're looking for a quality monitor for Windows applications, but a 17" is beyond your budget, you've found it. Congratulations.
bit awkward, but you can get the job done. You can mark words; that pops up a dialog box to let you assign tags to the words. It's all right, but sometimes I prefer to have a computer program build a list of all the words in the document and then go through and eliminate the ones I don't want indexed. There are indexing programs that do that, and more, but this isn't one of them. On the other hand, you can browse through your document and enter index key words as you encounter them, and Doc-to-Help will take care of things from there. It's considerably easier than using a card file, and most rival products don't have indexing at all.

The Doc-to-Help system is essentially a way to take paper documentation and convert it into on-line help files. The process is fast and painless: enormous existing documents can be turned into hypertext help files in days rather than weeks. Alternatively, by intelligent planning, you can create both documentation and on-line help for any project as you build the product itself.

If you're developing Windows products, you need this. Recommended.

Update on Viruses

I continue to recommend Dr. Solomon's Anti-Virus Toolkit for DOS. All my research indicates that the software does as good a job of detecting virus threats as any product I know, and furthermore, the S&S International staff vigorously seeks out new viruses and disassembles them, so it's kept up to date. The explanations of what viruses are and what they do are excellent; and Dr. Solomon's Virus Encyclopedia, which now comes with the Toolkit, explains every known virus in considerable detail.

Having said all that, I have a warning. S&S now sells a version of the Toolkit for Windows. Don't buy it, don't rely on it, and don't use it.

The only way you can run a program under Windows is to boot up your machine and then run Windows. That gives a virus a chance to go memory resident. I won't go into details, but a well-written virus, once memory resident, can evade just about every virus-detection scheme. Most won't, but some can.

The only way to be certain that your system isn't infected is to boot it with a known clean floppy disk and then run (preferably from a write-protected floppy disk) a good virus-detection program, like S&S's Toolkit for DOS. This is the advice Dr. Solomon and S&S International have always given, and good advice it is, too. Incidentally, the Toolkit for DOS comes with the Toolkit for Windows, which is just fine, but why pay for the Windows version in the first place?

Death Threat

I would like to perform a public service: I want to kill the mechanical engineer who designed the board system for the IBM PC bus—the one who put the little tabs on the bottom ends of the board mounts. For my own personal satisfaction, I would like to use something lingering with boiling oil, but the public service would be to see that this engineer doesn't work on anything else.

The system is unbelievably dumb; it's as if it were designed for computers that will never have boards changed and will not be moved around. Boards get loose. You can't get the screws in. If you try to change a couple of boards, you can tear half the flesh off your fingers and the backs of your hands.

For those who are going completely nuts installing boards, I have a tip: get a pair
BEFORE PROTECTING YOUR SOFTWARE... NEW!

TimeHASP
Protect Your Software Keep the Time

against piracy and unauthorized use, make sure that your protection system has all the following qualities:

A GOOD HARDWARE KEY
Hardware-based software protection systems are now the standard worldwide. However, not all keys are the same. A good key should have all the following features:
✓ Compatibility and transparency. The key should work without any problem on your customers' computers. The user should be able to forget the key after connecting it.
✓ Unbreakable electronics. A customized ASIC (Application Specific Integrated Circuit) component should be integrated in the key. This prevents reverse engineering and makes cracking virtually impossible.
✓ A unique and inaccessible software developer's code burnt into the ASIC. (This code should not be held in the key's memory, where it can be read and altered.)
✓ A Read/Write Memory inside the key should be available on demand. The memory should be writable in the field, on any PC, without any special programming equipment.
✓ Very low power consumption, enabling the key to work even under the worst power conditions, on PCs and laptops, with or without a printer.

POWERFUL SOFTWARE
Since it's practically impossible to crack or duplicate a key having all the features mentioned above, a pirate will usually go for the software linking the protected program to the key. Therefore, check that your protection software has all of the following:
✓ A Linkable Protection Module with which calls can be made to the key from any point in the protected program.
✓ An "Envelope" installation program. Such programs enhance security while making it possible to protect a software even without its source code.
✓ Sophisticated antidebugging and encryption mechanisms.

HASP®, THE PROFESSIONAL SOFTWARE PROTECTION SYSTEM, OFFERS YOU ALL THESE FEATURES AND MORE:
HASP was designed by a team of computer experts, professional cryptologists, and electrical engineers. As a result, HASP keys are supported by what is probably the best software in the market, and the HASP system has worked on every computer it has been tried on. In addition to all the features mentioned above, HASP provides:
✓ A Full Authorization System for protecting dozens of programs using only one key.
✓ A Pattern Code Security System (PCS) enabling parallel processing of multiple calls by the Linkable Protection Module.
✓ A Virus Detection option that can be incorporated in the protected program to check whether it has been infected by a virus or tampered with in any way.
✓ Several HASP keys can be daisy-chained.

NETHASP, SOFTWARE PROTECTION FOR NETWORKS
✓ Only one NetHASP key is needed to run a protected program from many stations in a network. NetHASP provides full support for protecting DOS and WINDOWS software under network environments, including Novell dedicated & non-dedicated servers, Lan Manager, Lantastic, Banyan, DLink, and NET-BIOS based LANs.

IN A TEST CARRIED OUT BY AN INDEPENDENT LAB, HASP WAS THE ONLY KEY WHICH WAS NOT BROKEN*.

OPERATING ENVIRONMENTS
✓ PC: DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX, AUTOCAD, DOS EXTENDERS
✓ MAC (ADB Port): System 6.0.5 and up
✓ NEC (Serial Port): DOS, WINDOWS

AND THE BOTTOM LINE:
We offer some of the most competitive prices in the market.
Since 1984, HASP has enabled thousands of software producers in more than 40 countries, including several Fortune 500 companies, to protect their software.

To learn more about why so many professionals have chosen HASP, call us for our low price evaluation package.

ALADDIN SOFTWARE SECURITY INC.

North America: 202 Broadhollow Rd. Suite #207 Melville, NY 11747, USA
Tel: 800-223 4277
Fax: 516-424 6300

International Office: ALADDIN KNOWLEDGE SYSTEMS LTD.
15 Belt Oved St., Tel-Aviv, Israel
PO:Box:1114 Tel-Aviv 61110, Tel: 972-3-5075795
Fax: 972-3-5075798

• Australia Conlab Pty. Ltd., Tel: 3 8985685
• Belgium Akkermans bvba, Tel: 3 2338826
• Canada CSFR ATLAS Ltd., Tel&Fax: 2 760568
• Chile Micrologica S.A., Tel: 562 222 1388
• Denmark SC Metric a/s, Tel: 42 804200
• France Logidata In., Tel: 50707373
• Germany CSS GmbH, Tel: 201 746806
• Greece Unibrain SA, Tel: 1 6895330
• Holland Akkermans BV, Tel: 45 240414
• Italy Partner Data S.r.l., Tel: 2 35101709
• Korea Dae-A Engineering, Tel: 2 848 4481
• Mexico Training Solutions, Tel: 4 5666014
• New Zealand Conlab Pty. Ltd., Tel: 3 8985685
• France CSFR ATLAS Ltd., Tel&Fax: 2 760568
• Germany CSS GmbH, Tel: 201 746806
• Greece Unibrain SA, Tel: 1 6895330
• Holland Akkermans BV, Tel: 45 240414
• Italy Partner Data S.r.l., Tel: 2 35101709
• Korea Dae-A Engineering, Tel: 2 848 4481
• Mexico Training Solutions, Tel: 4 5666014
• New Zealand Conlab Pty. Ltd., Tel: 3 8985685
• France CSFR ATLAS Ltd., Tel&Fax: 2 760568
• Germany CSS GmbH, Tel: 201 746806
• Greece Unibrain SA, Tel: 1 6895330
• Holland Akkermans BV, Tel: 45 240414
• Italy Partner Data S.r.l., Tel: 2 35101709
• Korea Dae-A Engineering, Tel: 2 848 4481

© Aladdin Knowledge Systems Ltd. 1985-1992

Circle 63 on Inquiry Card.

© 1992 Aladdin Knowledge Systems Ltd.


Operating Environments

PC: DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX, AUTOCAD, DOS EXTENDERS

MAC (ADB Port): System 6.0.5 and up

NEC (Serial Port): DOS, WINDOWS

Operating Systems

DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX

Networks

DOS, WINDOWS, OS/2, SCO UNIX, SCO XENIX, INTERACTIVE UNIX, AIX

ASCII

NETHERASHP, SOFTWARE PROTECTION FOR NETWORKS

Only one NetHASP key is needed to run a protected program from many stations in a network. NetHASP provides full support for protecting the DOS and WINDOWS software under network environments, including Novell dedicated & non-dedicated servers, Lan Manager, Lantastic, Banyan, DLink, and NET-BIOS based LANs.

IN A TEST CARRIED OUT BY AN INDEPENDENT LAB, HASP WAS THE ONLY KEY WHICH WAS NOT BROKEN*.


© Aladdin Knowledge Systems Ltd. 1985-1992

Circle 63 on Inquiry Card.
Introducing new ScreenStar™ from BitWise, the world's first portable with dual-page display. It's a 486 50MHz PC workstation constructed within a suitcase for unrivaled performance in a portable package.

ScreenStar's massive 21.3" gas plasma screen folds flat within the suitcase, and easily displays two 8-1/2" x 11" documents at full size, to powerfully present data in meetings, in the field, or on the road.

Imagine the possibilities. Impressively present to large groups. Effortlessly run the most demanding software. Effectively travel with a powerful document imaging system.

Portable computing without compromise. Discover the quality and innovation of ScreenStar. Otherwise, it's not a BitWise.

800-367-5906
BitWise Designs, Inc.
Technology Center
Rotterdam Industrial Park
Schenectady, N.Y. 12306

USER'S COLUMN

LaserMaster
A quick note about LaserMaster. The National Association of Theater Owners has adopted the LaserMaster WinJet, Aldus PageMaker, and Windows to do all their publications, including the program for their yearly convention.

I have reported on the WinJet before: it installs in your Hewlett-Packard LaserJet III and connects to another board in your Windows computer. The result is that it does the raster-image processing in your computer and squirts that to the printer, making the whole process incredibly fast compared to what PageMaker normally does. For single-user desktop layouts and publications, it's hard to beat. Alex installed the system some time ago and says the only calls he gets from that customer are to tell him how terrific it is.

The Mail Dilemma
I like MCI Mail. It's not as elegant as AT&T's E-mail service, but it has been around a long time, a lot of people I want to talk to are on it, and I'm used to it. Every now and then, there's a glitch. The most common one used to be that some new PR firm would get on, discover just how many columnists and editors and freelance writers are on MCI, and build up an enormous mailing list to which they'd send new product announcements. Unfortunately, they wouldn't study the manual on how to handle mail lists, and the result would be that it would take 10 minutes to download the header and "To:" list before the message came in. The first time that happened, I thought it was amusing, and besides, I got a good mail list out of it. The next dozen times weren't so funny.

The main reason I use MCI Mail, though, is that Norton Commander has a built-in front end for it. Set Commander up properly, and you can tell it to go get your MCI Mail. You can then read that mail and reply to it off-line. The next time Commander goes for the MCI—either because you sent it manually or because you set it to do it automatically—it will first send out all your replies and other messages. This can all happen invisibly in the night or in the background while you work on something else. Lotus Express uses the same method to achieve the same result.

Alas, the past few weeks when I sent Commander after MCI Mail, it failed as often as not. Sometimes it would get "ring no answer," which is understandable at busy times; but often I'd get an answer, the system would appear to lock on at 2400
STATISTICA/W (for Windows) Complete Statistical System with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures.

- Complete Windows 3.1 support, DDE, OLE, TT-fonts, multiple toolbars, right mouse button support.
- Unlimited numbers of data-, results-, and graph-windows.
- Inter-window integration: data, results, and graphs can be treated as objects and converted into one another in a number of ways.
- The largest selection of statistics and graphs in a single system: comprehensive implementations of Exploratory techniques; multifaceted tables with headers (presentation-quality reports); nonparametric; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANOVA/MANOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling; forecasting; lag analysis; quality control; process analysis; experimental design (with Taguchi); and much more.
- Manuals with comprehensive introductions to each procedure and examples.
- Hypertext-based Stats Advisor expert system.
- Extensive data management facilities (spreadsheet with long formulas, block operations, advanced clipboard support, system hot links, relational merge, data verification, powerful programming language).
- Batch command language and macros also supported, "turn-key system" options.
- All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with toolbars, pop-up windows, and instant 2D, 3D and multiple graphs).
- Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs).
- Megafile Manager with up to 32,000 variables (8 Mb) per record.
- Unlimited size of files; extended ("quadruple") precision;
- unmatched speed; exchanges data and graphs with other applications via DDE or an extensive selection of file import/export facilities.
- Hundreds of types of graphs, including categorized multiple 2D and 3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs.
- Facilities to custom design new graphs and add them permanently to menu.
- On-screen graph customization with advanced drawing tools, interactive stretching and resizing of complex objects, interactive embedding of graphs and artwork, special effects, icons, maps, multi-graphics management, page layout control for slides and printouts; unmatched speed of graph redraw.
- Interactive rotation, perspective and cross-sections of all 3D and 4D graphs.
- Extensive selection of tools for graphical exploration of data: fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets.
- Price $995.

Quick STATISTICA/W (for Windows) A comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/W.

Price $495.

STATISTICA/DOS (for DOS) A STATISTICA/W-compatible data analysis system.

Price $795.

Quick STATISTICA/DOS (for DOS) A subset of STATISTICA/DOS statistics and graphics.

Price $295.

Domestic sh/s $10 per product, 14-day money back guarantee.

Circle 134 on Inquiry Card.

StatSoft™

2325 E. 13th St. * Tulsa, OK 74104 * (918) 563-4149
Fax: (918) 563-4376
Overseas Offices: Statsoft of Europe (Hamburg, FRG), ph: 040/4208347, fax: 040/4911310; Statsoft UK (London, UK), ph: 040/4208322, fax: 040/4208365; Statsoft Pacific (Melbourne, Australia), ph: (03) 663 6588, fax: (03) 663 0117; Statsoft Canada (Ontario), ph: 416-845-0737, fax: 416-845-0738; Statsoft of Europe (Hamburg, FRG), ph: 040/4208347, fax: 040/4208365; Statsoft Pacific (Melbourne, Australia), ph: (03) 663 6588, fax: (03) 663 0117; Statsoft Canada (Ontario), ph: 416-845-0737, fax: 416-845-0738.


StatSoft, STATISTICA/W, Quick STATISTICA/W, STATISTICA/DOS, Quick STATISTICA/DOS, and Scrollsheets are trademarks of StatSoft, Inc.
bps, and then it would never gain admission to MCI. Once that happened 50 times in a row.

The remedy turned out to be simple: although Commander tells you to enter the highest speed for your modem (up to 9600 bps), you shouldn’t do that. Instead, set 2400 bps, which is the highest speed I’ve ever seen it lock on anyway. That won’t end “ring no answer,” but it does stop the nonsense of not being able to handshake with the MCI Mail modems.

I’m told that MCI will bring out its own front-end program Real Soon Now, and perhaps that will be superior to Norton Commander. Until then, I have Commander Mail with its own Windows PIF (program information file), 2500 ticks in foreground and background, and it’s good enough.

SuperCard

Roberta is jazzing up her reading program and transferring it to other systems. Part of that is being done by Chris Innanen, who’s converting it into SuperCard for the Mac. SuperCard is, unsurprisingly, a superset of the HyperCard programming toolkit for the Mac. Actually, it’s quite a lot more than that. They don’t call SuperCard a multimedia programming language because that might frighten off potential customers; but in fact, SuperCard is powerful enough to create commercial-quality stand-alone programs while remaining easy to use.

I have said for years that the real goal of the computer revolution is to get ordinary users developing computer applications. SuperCard and Apple’s Mac together are a giant step in that direction. With SuperCard you can build simple programs employing sound and graphics to achieve complex results. You can also build very complicated programs: SuperCard contains most of the BASIC control structures, such as IF...THEN, DO WHILE, DO UNTIL, and FOR...NEXT (the last three are found under the REPEAT command).

SuperCard contains SuperTalk, animation tools, and suchlike. It has a debugger (called a run-time editor). It creates objects; and of course it integrates all this rather seamlessly into the Mac Desktop environment. Roberta, who has no interest in programming except as a means of getting her education programs running, is quite thrilled with SuperCard’s capabilities. You may also want Aldus SuperPaint, which makes drawing with SuperCard a bit easier.

Both SuperPaint and SuperCard were developed by an outfit known as Silicon Beach, before it was bought out by Aldus. I keep hearing hints of a new-and-improved SuperCard, but don’t let that stop you from getting it now. Aldus has always had reasonable upgrade policies.

If you’re a Mac user thinking about developing programs but afraid that will be too hard, get SuperCard. It’s a great introduction to how to make your machine do things for you. Recommended.

PowerBook Note

If you use LapLink Mac with a PowerBook and it just won’t link up, open the Control Panel, open the Portable icon, and click on external modem. Like a lot of Apple interface commands, this is obvious once thought of, but it’s not precisely intuitive.

PowerBooks are showing up all over the place now. Older ones are offered at astonishingly low prices, low enough that we’ve thought wistfully of bundling Roberta’s reading program in with one as a stand-alone learn-to-read kit. We won’t do that, but I wish someone would.
The World's Best Selling UNIX Clone Just Got Better.

Now with full 32-bit implementation!

If you want to ignite your 32-bit hardware with the multi-user, multi-tasking power of UNIX, Coherent 4.0 has arrived. And if you're operating or selling small business network systems with dozens of users, that's really good news. Because Coherent 4.0 is what you want in UNIX at a price that's hard to believe.

Run UNIX applications today!

Coherent is now binary compatible with UNIX. Most UNIX PC applications port with a simple recompile and many now run right out of the box. The list is growing everyday, so call for details.

Yes, It's For Real!

How can it be? First of all, Coherent was independently developed by the Mark Williams Company so you don't pay for UNIX licensing fees. You don't pay any mark-up or reseller costs either. Coherent is only sold directly to you.

In fact, over 40,000 copies of Coherent have already been sold. And, like the ones we quote here, virtually every critic who's reviewed Coherent has raved about it.

So Much Less, Yet So Much More.

As a virtual clone of UNIX, Coherent embraces the original UNIX philosophy: Small is beautiful. Small price, yes. But there's more, much more, to Coherent than its amazing price.

Requiring only 10 megabytes of disk space, Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. And it runs with as little as 1 MB of memory versus 4 MB for other UNIX versions.

The World's Only Plug And Play UNIX Clone.

You'll have Coherent up and running with a fraction of the time and effort it takes for other UNIX versions. Our six disk installation is a breeze compared to their 25. You'll also learn it faster and increase overall performance. All because Coherent is smaller, faster... and better.

Small, But So Complete.

Make no mistake, Coherent is a wholly professional development system. You get a complete C compiler, assembler and over 200 UNIX commands including full sets of functions for development, administration, maintenance and text processing.

Coherent also comes with UUCP capabilities that connect you to a world-wide network of free software, news and millions of UNIX users. And it's all clearly documented in Coherent's highly praised 1200 page manual.

Experience, Supported, Guaranteed.

Mark Williams Company has been developing professional programming tools since 1976. Our commitment to our products and users is unsurpassed. Users applaud our popular BBS and the widely acclaimed telephone support they get free from Coherent developers.

Still, we're not asking you to take a chance on Coherent. We've made it foolproof to see for yourself—with a 60-day money-back, no hassles guarantee. So pick up that phone and order Coherent now. And the best way to UNIX will be on its way to you!

800-MARK WMS
(800-627-5967 or 708-291-6700, FAX: 708-291-6750)
60-DAY MONEY BACK GUARANTEE!

Coherent is a trademark of Mark Williams Company. UNIX is a trademark of USL.

Mark Williams Company
60 Revere Drive, Northbrook, IL 60062

Distributors: Australia + 07-266-2270, Brazil + 011-883-2299, Czech. + 06-32-62877, France + 1-4741-4519, 1-4672-8074, Germany + 051-53-7295, Greece + (01) 222-3511, Holland + 020-386-899, Hungary + 013-6998, Malaysia + 03-750-4477, Venezuela/Caribbean + 1-809-723-5000, Sweden + 06-69-18090, UK + (0) 81-541-5466

"Coherent comes so fully qualified as a UNIX clone, you find yourself thinking, 'I can't believe it's not UNIX'"—Sean Fulton, UNIX Today!
Quotemaster Plus
Instructions on installing this for Windows aren't clear, but otherwise it's not a bad program. The quote list is different from Bartlett's Familiar Quotations, which may be all to the good. It's easy to use, and there are other subject quote lists available that use the same search engine.

It's a reasonable tool for spicing up a speech or essay, and I found a couple of quotes to use as aphorisms at chapter breaks. It's worth having a look at if you deal in words.

Programmer's Tool
Alloc-GC is a garbage-collecting replacement for the allocation functions that come with C compilers. Programs that use it don't need to explicitly deallocate memory, because unreferenced blocks are reclaimed and reused when memory runs low. C++, like C, uses explicit deallocation; garbage collection is used in Smalltalk, Lisp, and suchlike. I make you aware of it. I don't like C++

They're Back
Amiga and Commodore America have come back in a big way: new machines, great new plans. More in the future, but if you're curious about what's available for the Amiga, a simple way to get Commodore's Guide to the Amiga from Pim Publications (P.O. Box 2140, Fall River, MA 02722). It describes and gives sources for about 10 zillion Amiga programs and accessories. You might be amazed at how much there is.

Winding Down
The onion of the month goes to the Library of Computer Information and Sciences, which for two years continues to send to “Estate of Barbara Yost” solicitations to rejoin the book club, to the annoyance of her heirs and despite repeated protests. The Gripping Hand (Simon and Schuster), by Larry Niven and Jerry Pournelle, is the sequel to The Mote in God’s Eye, and it should be available in bookstores about the time you read this. We wrote Mote in 1972, and I'm pleased to say that we haven’t had any objections to it.


Next month: Space Adventure from Knowledge Adventure (you'll love it); a lot more about networks and networking; and, with luck, just a lot of CD-ROMs that have accumulated at Chaos Manor. Now I'm off to the Hackers' Conference. This year I'm taking MIT's Marvin Minsky, which ought to prove interesting.

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerry."
Unlimited connect time to access CompuServe basic services, now only $7.95 a month.

You can start with the basics at a flat monthly rate, with extended services available on a pay-as-you-go basis.

For more information about CompuServe’s new basic services, just mail this card, or call 1 800 848-8199.

Name ____________________________________________________________

Company (If Applicable) ____________________________________________

Address __________________________________________________________

City, State, Zip ____________________________________________________

Telephone (_____) ___________________________________________ CompuServe
With CompuServe, you'll always have more to look forward to.

It's one thing to discover something you like. But to realize there's more of it than you ever imagined is even better. And that's what CompuServe is all about.

Tap into travel information, hotel reservations, stock quotes, hardware and software support, a shopping mall, the news, interactive games, and forums. For the experienced user, there's even free software and shareware. On-screen menus and an index make it all easy to access, so you get the most out of your time and money.

A one-time membership fee and $7.95 a month let you use our basic services as often as you like: news, sports, weather, shopping, reference materials, our E-mail service of 60 messages a month, and more. Plus, there's a whole universe of other services available at nominal additional charges.

For more information or to order, see your computer dealer or call 1 800 848-8199. Outside the United States, call 614 457-0802. Because no information service lets you dig deeper or farther than CompuServe.

CompuServe®
The information service you won't outgrow.
In Canada, call 1 800 465-1234. **Prices are current as of 10/27/92. All prices listed are MRRP. Retailer prices may vary. IBM, AIX and RISC System/6000 are registered trademarks and PowerPC and POWERstation are trademarks of International Business Machines Corporation. All other products are trademarks or registered trademarks of their respective companies. ©1992 IBM Corp.
The POWERstation 220: Here today.

When you're ready for raw power and performance at a low price, climb on a leader of the pack. The RISC System/6000® POWERstation™ 220.

Cruise with leading UNIX® desktop price/performance today that has the kind of muscle and brains to keep pace with you tomorrow. And in the future when you're ready to rev up the performance, you'll be able to upgrade the 220 processor. It's even ready for the PowerPC® 601 microprocessor model, which will offer up to two times the performance when available.

With AIX®, IBM's commercial-strength UNIX, you'll have access to more than 6,000 solutions. Solutions for software development, retail stores, accounting and transaction processing, just to name a few. And AIX is compliant with all leading UNIX industry standards. It also gives you the horsepower you need for distributed client/server applications and connectivity to systems from Sun®, HP, DEC® and IBM.

More tomorrow.

And don't forget IBM's unequalled service and support. You can count on us to install machines, configure networks and integrate all your systems, IBM or non-IBM.

So isn't it time you took this bad boy for a test drive?

Call your IBM marketing representative or Business Partner. For literature, call 1 800 IBM-6676, ext. 715.*

• Upgradable to PowerPC.
• Great value today, growth for tomorrow.
• AIX, IBM's commercial-strength UNIX.
• Unequalled service and support.
• Complete systems start at $5,950**
Start the Presses

Affordable do-it-yourself CD-ROM publishing will revolutionize how you distribute and use information

JON UDELL

When BYTE first featured CD-ROM on its cover in 1986, we said it would reinvent publishing. Today, CD-ROM is finally poised to deliver. CD-ROM drives are now faster and cheaper, and with the installed base (now estimated at 5 million) doubling every year, text-based and multimedia titles are proliferating. Kodak’s Photo CD system establishes CD-ROM as a key ingredient in digital photography, and software makers are flocking to CD-ROM as a convenient alternative to distributing code and manuals. Businesses increasingly find CD-ROM a compelling medium for internal communication. And for governments obliged to distribute data to citizens, the medium of choice is becoming CD-ROM.

Into this bubbling mixture now drops a catalyst for even more rapid acceptance of CD-ROM: sub-$10,000 CD-R (CD recordable) drives that bring CD-ROM-making to the desktop. These new low-cost printing presses will shift the electronic publishing revolution into high gear.

CD-R is ideal for three kinds of applications: prototyping titles destined for conventional pressing, final production of discs for limited distribution or even single use, and archiving. Low-volume production is CD-R’s forte.

At the National Library of Medicine (Bethesda, MD), a research library within the National Institutes of Health, searching for medical periodicals until recently meant wading through fat notebooks full of printouts. Now that data finds its way onto a custom CD-ROM. A single copy of the disc, produced monthly using the Sony CD-R drive and placed in a networked CD-ROM reader, gives researchers electronic access to medical citations.

Maceds (Birmingham, AL), a developer of turnkey document-control systems for the managed health care industry, uses CD-R to store scanned images of claims forms. The discs reside in huge banks of networked CD-ROM readers, and Maceds’s software marries CD-ROM-based document images to fielded data in Briefive databases kept on NetWare servers. One of Maceds’s clients scans more than 10,000 forms a day. When the accumulated image data reaches 600 MB—which happens once or twice a day—it’s written to a CD-R disc using a Philips drive. The total capacity of the system will soon double to 168 networked readers and nearly 100 GB of document images.

The SAS Institute (Cary, NC), developer of the statistical software package that is called SPSS, uses the Makedisc software from Young Minds and the Philips
Once you read your first hand-made CD-R disc in a standard CD-ROM player, you'll be hooked on the power of this exciting technology. Desktop CD-ROM recording is very new, though, and like any pioneer you should expect some of the hardships we encountered when we tested four of the current crop of CD-R solutions (see photo A). Their very different approaches to both hardware and software attest to the embryonic state of CD-R.

**CD-Studios, YMI**

We wondered how this deluxe solution for Unix-based CD-ROM makers could guarantee that a Unix host will sustain the 300 Kbps required by the double-speed Philips CDD 521 included with the package. The answer is that it doesn't have to. Young Minds, Inc., inserts a proprietary controller (shown in photo A) between the host and the recorder. The package sells for $18,250.

The CD-Studio controller is essentially a headless PC (i.e., no monitor or keyboard) with two high-performance SCSI adapters and a 1-GB disk. One adapter handles communications with the Unix host; the other talks to the Philips recorder. The controller powers up running custom YMI code that makes it appear to Unix as an 8-millimeter Exabyte tape device. To test that it's working, you can use the Unix `tar` command to copy files to the "tape" and read them back. What you can't do, though, is verify that the CD recorder is properly hooked up. We wish YMI had added LEDs to the controller's front panel to monitor the status of the recorder.

Our Unix test-bed was a Sun Sparcstation 2 running SunOS 4.1.2. YMI's Makedisc walked the tree of sources we fed it and built a 620- MB CD-ROM image on the controller's disk. To transfer that image to the recorder, we issued a standard Unix `mt` (mag tape) command, which tells the YMI controller's pseudo-tape device driver to start the recorder. After that, there's no feedback from the Unix console or the controller. You simply watch for the CDD 521's write LED to turn off.

Everything worked smoothly, and our first disc was a success, although even BYTE's Unix experts found YMI's documentation cryptic. Because we used Makedisc's `-R` option to add Rock Ridge extensions, the resulting CD-ROM had the look of a Posix file system (e.g., long names, symbolic links, and permissions) mounted in the Sparcstation's CD-ROM drive. (DOS and Macintosh systems saw the same disc as a standard ISO 9660 CD-ROM.)

Makedisc also stores descriptions of the Unix-to-ISO 9660 mapping in a text file at each node of the ISO 9660 tree. That way, Unixes other than the two that now support Rock Ridge (SunOS and NextStep) can recover the original names. YMI's `cd_link` enables such systems to map a hard disk-based tree of real Unix filenames to the corresponding tree of short, uppercase-only ISO 9660 filenames on the CD-ROM. YMI also provides an NFS (Network File System)-compatible file system called PFS (Portable File System) that handles CD-ROM sharing over Unix networks more efficiently than NFS.

**Personal RomMaker, JVC**

Mastering your disc on JVC Information Products' Personal RomMaker is about as easy as it gets. Personal RomMaker ($12,799) requires a Mac Iici or better, 4 MB of RAM, System 7.x, and HyperCard 2.1 or higher. In addition, you'll need enough disk space to store your original data files, but there's no need for fast storage here: RomMaker can run happily off shared disks or network servers.

To burn a ROM, you need either fast access to the data files or a fast hard drive with a premastered image. JVC uses the latter and incorporates a high-speed Maxtor 8760 SCSI drive into the Personal RomMaker system (this is the same drive we chose for our DOS testing). You create your disc by deciding what files you want stored and how you want them arranged. RomMaker gives you a simple script editor for creating an ASCII list of these files and folders. We'd prefer it if RomMaker used standard Apple file dialogues for selecting files, but the ASCII file syntax is simple enough to handle.

The premastering stage runs through your file list and then copies each file from the Mac's file system to RomMaker's hard drive in CD-ROM format. You can choose from several disc formats: Apple HFS, ISO 9660, High

---

**Photo A:** (Clockwise from bottom left): The Sony CDW-900E, Philips CDD 521 (in Kodak guise), JVC Personal RomMaker, and YMI CD-Studio controller.
Sierra, or a hybrid HFS and ISO 9660 format. Our test disc consists of 620 MB of images. To find enough free disk space, we used System 7’s file sharing to convert one of our Quads into a file server. Over a thin Ethernet link, it took about 1½ hours to suck the 620 MB through the network and create the CD-ROM image.

After the premastering, you can mount the hard drive as a CD-ROM image, manipulate the folder and window structure, and test your application. To create the CD-ROM, you simply choose the appropriate menu selection. After verifying that you’ve placed a blank in the drive, RomMaker trundles off and copies the hard drive contents to the CD-ROM recorder. If you have the optional DAT (digital audiotape) drive, you can opt to copy the image to DAT for a commercial premastering house.

**CD Record, Dataware**

Dataware resells the Philips CDD 521 for the DOS market with its CD Record software ($8995 for the package). Unlike Philips’ CD-Write, which performs ISO 9660 formatting on the fly as it transfers files from a hard disk to the write-once disc, CD Record requires two steps: First build a virtual image, and then write that image to the CD.

First-generation premastering systems, like Dataware’s CD Prepare, convert a DOS hierarchy that may contain thousands of files into one huge file that’s a bit-for-bit image of an ISO 9660 file system. The image file serves two purposes. With the software emulator such systems typically provide, you can fool MSCDEX into seeing the image as a real CD-ROM. That means you can test your retrieval application before mastering any discs. Once satisfied with the image, you dump it to tape for shipment to a mastering house.

CD-R changes the rules of the game. Now you can build your own test disc, which is also a convenient delivery vehicle. In principle, there’s no need for an image file, or for an extra 660-MB hard disk to store it on. But given the high cost of CD-R media, it’s still useful to have an image file available for preliminary testing. CD Record’s virtual image meets that need—without doubling your storage requirement—by adding a thin ISO 9660 mapping layer to an existing DOS file system.

CD Record has some drawbacks, though. Building that image took us over an hour for our 8000-file data set, and that still left an additional half hour to cut the disc. By contrast, CD-Write, although lacking the useful virtual image capability, does the entire job—formatting and disc cutting—in half an hour. Also, CD Record’s virtual image lives in RAM and does not survive a reboot. If you need to make a CONFIG.SYS change after running vmap (the ISO 9660 mapper) but before starting cdrecord (the recorder), you’ll have to rerun vmap—an inconvenience that Dataware admits should be fixed.

Hardware trouble botched our first two discs. While DOS can disgorge files fast enough to sustain 300 Kbps to the double-speed CDD 521 for the duration of a write session, conditions must be near-optimal. After rearranging some questionable SCSI cabling, we did successfully cut discs. But the experience reminded us that a more expensive solution involving a dedicated hard disk (e.g., YMI, JVC) is also inherently more reliable.

**Multimedia Formatter, Sony**

Sony’s rack-mountable CDW-900E (not sold at retail) offers several unique features. In addition to the SCSI-2 connectors, its back panel sports an extra pair of proprietary connectors. These enable you to link a master CDW-900E to as many as 15 slaves for simultaneously writing multiple CDs. (Additional connectors, not currently used in any PC-hosted application, support recording audio CD.) The drive’s capacious 3-MB buffer helps ensure the sustained flow of data on which CD recording critically depends. Moreover, since it can run at single or double speed, the host need not support the 300 Kbps required by the Philips drive.

Like CD Record, Sony’s Multimedia ISO Formatter layers a virtual image on top of an existing DOS file system. However, it provides no emulator, nor can the drive work as an ordinary CD-ROM reader (as the Philips drive does). When you cut a disc from a virtual image, Sony runs the drive at single speed to ensure best results. For faster writing, you have the option of building a real image on the hard disk and cutting it to the disc at double speed.

Like the drive itself, Sony’s formatting software has some unique features. In addition to straight ISO 9660 CD-ROMs, it can apply the secret sauce needed to make titles for Sony’s Data Discman and MMCD Player. The Data Discman plays 8-centimeter discs that are in XA format but have nonstandard volume information. Another secret sauce makes the MMCD Player’s regular-size XA discs. Sony’s formatting software, which presents a DOS-based GUI, supports both these formats.

For Unix users, YMI’s CD-Studio, with its Rock Ridge support, is a solid—albeit pricey—solution. Mac users who can afford JVC’s Personal RomMaker will appreciate its outstanding ease of use and HFS support. For DOS users, both the Sony and Philips drives have their advantages. The Sony CDW-900E’s large buffer and single-speed mode could improve reliability in some configurations, and its support for Sony’s Data Discman and MMCD Player is unique. The Philips drive, widely supported by resellers, is a solid performer and—at least for now—the most inexpensive CD-R solution.

Jon Udell is a BYTE senior technical editor at large. Howard Eglowstein is a BYTE Lab testing editor. You can contact them on BIX as “jurell” and “heglowstein,” respectively.

---

**COMPANY INFO**

Dataware Technologies, Inc.
(617) 621-0820
fax: (617) 621-0307
Circle 1075 on Inquiry Card.

JVC Information Products Co.
(714) 965-2610
fax: (714) 968-9071
Circle 1076 on Inquiry Card.

Sony Corp. of America
(800) 352-7669
(201) 930-6432
Circle 1077 on Inquiry Card.

Young Minds, Inc.
(909) 335-1350
fax: (909) 798-0488
Circle 1078 on Inquiry Card.

FEBRUARY 1993 • BYTE 119
Buying a CD-ROM Drive

TOM HALFHILL

The proliferation of CD standards, including CD-ROM XA and multisession Photo CD, makes it harder than ever to decide which drive to buy. Further complicating the decision is the availability of dual-speed drives that, for a $200 premium, double throughput. One alternative is simply to wait a few months: Drive makers are constantly updating their products, and they say that adding XA or Photo CD support won’t be a big deal. But the definitions of these features can be slippery.

Consider NEC’s “XA-ready” drives, which can read mode 2 format. To be fully XA compatible, they will need additional circuitry to decode interleaved channels of audio and perform ADPCM (Adaptive Differential Pulse Code Modulation) decompression. To add these capabilities, you’re likely to need a new interface card. The same is true of XA-ready drives made by Sony and others. Currently, the only Sony devices with built-in ADPCM chips are the Data Discman and the MMCD Player. Sony says, however, that it will add the relatively inexpensive ADPCM chips to its CD-ROM drives if XA compatibility becomes more important.

So far, the most compelling reason to have XA is Kodak’s Photo CD. To read a Photo CD, a CD-ROM drive must be XA ready, although it does not have to be fully XA compatible. However, full XA compatibility with ADPCM will be required for future Photo CD applications that will use interleaved audio. Lacking ADPCM, an XA-ready CD-ROM drive could play sound bites attached to individual images, but it couldn’t play a continuous audio track while reading one image after another. For an impressive business presentation or narrated slide show, you’d need full XA.

Another desirable feature in a CD-ROM drive is the ability to read multisession Photo CDs. Several drives can read the first batch of images written to a Photo CD disc. But when you add another batch of pictures, it becomes a multisession CD, and only a handful of drives can track the modified directory structure and locate the additional images.

“I don’t think multisession is a big deal,” says Pat Forbes, a CD-ROM hardware manager at NEC Technologies (Wood Dale, IL), “but Kodak is putting a lot of marketing behind the idea of multisession, and the public perception will be that multisession is important.” As a result, virtually all major manufacturers will be adding multisession capability to their new drives. Usually it requires a patch to the drive’s firmware, plus some modifications to the servo tracking system so the device knows what to do when the laser pick-up stumbles on an unrecorded region of the disc. Such modifications add little or nothing to the retail price of a CD-ROM drive.

If you opt for a dual-speed drive, though, you will pay a premium. NEC introduced this feature in 1992, and it’s catching on fast. To see why, compare the specifications: A typical single-speed drive might have an average seek time of 450 milliseconds and a data transfer rate of 130 Kbps. A dual-speed drive’s numbers might be 280 ms and 300 Kbps. Such performance is still anemic by hard drive standards, but it makes a big difference when you’re reading high-resolution Photo CD images, which can run to 6 MB in size. The next frontier is likely to be 600-Kbps “quadspeed” drives like Pioneer’s new DRM-604X.

Here’s the bottom line. If you need a CD-ROM drive to access static information—encyclopedias, technical manuals, reference books, and so on—you can get by with an inexpensive single-speed drive without XA or multisession support. For multimedia CD-ROM applications involving sound and animation, consider a dual-speed drive for best throughput. If you anticipate using Photo CD at all, you’ll need at least an XA-ready single-session drive. For serious Photo CD work, settle for nothing less than a dual-speed drive with full XA and multisession capability.

Tom Halfhill is BYTE’s senior news editor in San Francisco. You can reach him on BIX as “thalfhill.”

Drive to build custom CD-ROMs for its Unix clientele. For each disc, SAS selects an appropriate subset of programs from its large family of products and uniquely serializes the programs to copyright them.

The U.S. Geological Survey (Reston, VA) has used CD-R since 1989. To equip its field offices, a $60,000 Meridian solution that uses a Yamaha drive “was just too rich for the taxpayers’ pocketbook,” says Dave Traudt, manager of the USGS CD-ROM support center. Traudt placed low-cost CD-R drives in seven field offices and is buying four more. “Our agency has a very tight budget; that should tell you a lot about how we see recordable technology,” he notes.

CD-R has been available to businesses flush with cash for several years. Now, affordable CD-R from Philips (the $7995 CDD 521), Sony (the CD-900W, not sold at retail), JVC (the $12,799 Personal RomMaker and $9995 Personal Archiver), and Pinnacle Micro (the $4995 RCD 202) have put the technology within reach of a vast new segment of users (see the text box “Affordable CD-R Drives” on page 118).

One Drive Reads All

Without CD-R, CD-ROM mastering and replication require that the data, usually on 9-track tape or DAT (digital audiotape), be sent to an outside duplicator that uses the same multimillion-dollar equipment that stamps out audio CDs. The new recordable drives produce an equivalent product—CD-ROM discs containing files in the standard ISO 9660 format that ordinary CD-ROM players can read (see the text box “Buying a CD-ROM Drive” above). But CD-R (or CD Write-Once) discs aren’t replicated from a master. Each is a custom edition that is made by copying data from a
The Quality Memory Solution

Phar Lap DOS-Extenders

When your reputation’s at stake...

We know how much work you put into building your product. Why use inferior tools that often create more problems than they solve? With a Phar Lap DOS-Extender, you know you’re getting industry-leading, market-tested tools that have worked reliably for thousands of developers. Other DOS extenders simply can’t measure up. Let Phar Lap show you what a DOS extender should be.

Build multi-megabyte DOS programs with Phar Lap’s DOS-Extenders!

286 DOS-Extender™ — it’s never been so easy! With our 286 DOS-Extender and your Microsoft C/C++, Borland C++ or Microsoft Fortran Compiler, you’ve got all the tools you’ll need to quickly and easily build multi-megabyte protected-mode applications — often simply relinking without making source code changes. Now you can build protected mode applications that access up to 16 megabytes of memory on any DOS-based 286, 386, 386SX, or i486 PC — without changing development tools! 286 DOS-Extender is also compatible with both Borland’s Turbo Debugger and Microsoft’s linker and CodeView debugger.

386 DOS-Extender™ — the ultimate in 32-bit power. 386 DOS-Extender turns DOS into a true 32-bit operating system with a flat, 32-bit address space. Your program can access all the memory available in the machine — up to 4 gigabytes! 386 DOS-Extender runs on any DOS-based 80386, 386SX, or i486 PC, and has been used in over 800 applications, including AutoCAD 386 and IBM’s Interleaf Publisher. It is backed by a full complement of 32-bit languages, including C, C++, Fortran, Pascal, Ada and Assembler. With true 32-bit performance, you can finally build workstation-class applications for the PC.

New! 386 DOS-Extender 5.0 now supports 32-bit Microsoft C/C++!

CALL 617-661-1510

<table>
<thead>
<tr>
<th>Phar Lap DOS-Extender</th>
<th>Vendor A</th>
<th>Vendor B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maturity</td>
<td>Over 5 years and 1000 applications</td>
<td>Less than a year</td>
</tr>
<tr>
<td>Memory Model</td>
<td>Safe</td>
<td>Dangerous</td>
</tr>
<tr>
<td>Compatibility</td>
<td>INT 15, XMS, VCP, DPMI</td>
<td>XMS, DPMI</td>
</tr>
<tr>
<td>Library Support</td>
<td>Extensive list of 32-bit libraries</td>
<td>Limited library support</td>
</tr>
<tr>
<td>Documentation</td>
<td>Extensive and detailed</td>
<td>Limited</td>
</tr>
</tbody>
</table>

Shatter the 640K barrier and build multi-megabyte DOS applications.

No more suffering with overlays or EMS.

Other DOS extenders can let common programming errors cause system crashes.

The CD-R drive’s high-powered laser burns pits into a pregrooved 120-millimeter disc that is a sandwich of polycarbonate substrate, organic dye, and a gold reflective layer (see figures 1 and 2). The half-hour or hour required for this transfer and the $25 to $40 cost of the blank dictate that CD-R will complement rather than replace mastering and replication.

**Popular Publishing**

All organizations collect and disseminate information. Several innovative ones now publish their parts catalogs, training manuals, technical documentation, and other forms of mission-critical data on CD-ROM. A CD-ROM disc is not only infinitely smaller, lighter, and cheaper to transmit than the equivalent tower of 200 Webster’s dictionaries, but is also far more useful, because it is electronically searchable.

By lowering the barrier to entry, CD-R will dramatically expand the number of CD-ROM publishers and applications. Companies that produce discs using CD-R have to worry about the same duplication economics as before, to a point. Depending on the cost of the CD-R media, the break-even point for making copies using CD-R is between 20 and 100 discs. Above that, conventional replication will be cheaper (see figure 3 on page 131). In some cases, factors that aren’t purely economic (e.g., convenience or security) could push the ball into CD-R’s court.

While reviewing the CDD 521 Philips drive (see “Desktop CD-ROM Publishing,” January BYTE), I built a prototype of a disc containing BYTE’s text from the last six years—a possibility suggested by the BYTE cover story on CD-ROM in the May 1986 issue (see photo 1). (The project had long been contemplated as a tool for editorial research.) The recordable drive made the project feasible, and being able to demonstrate a real CD-ROM disc galvanized support as nothing else could have.

I doubt that our situation is unique. CD-R’s advent will spur countless fence-sitters to action. Says Larry Schiller, president and CEO of the Bureau of Electronic Publishing, a CD-ROM distributor (Parsippany, NJ), “Just about every business with sales of $10 million or more will buy a recording drive.”

Internal disc production has security benefits, too. Military, government, or corporate users who must publish highly sensitive information on CD-ROM may not want to release that data, even temporarily, to an outside mastering facility. With a secure in-house CD-R system, the secrets can be safely reproduced.

---

**Photo 1:** BYTE touted the promise of CD-ROM to revolutionize publishing on the cover of our May 1986 issue. Today, CD-R appears poised to deliver on that promise.

---

**Figure 1:**

(a) In a standard CD-ROM drive, the laser’s orientation is perpendicular. The beam takes a 90-degree bend en route to the disc and then reflects back to the photodiode. (b) In a CD-R drive, the path from laser to disc runs straight. The condenser lens couples the light to improve the laser’s output, and the forward sense diode measures its intensity. The quarter-wave plate rotates the beam’s polarizing direction twice, so the reflected light takes a 90-degree bend on its way to the photodiode.

(Figures courtesy of Philips Consumer Electronics Co.)
Don't Shoot It, Troubleshoot It.

PC WON'T BOOT? KICKSTART IT!

Don't replace your motherboard, use KickStart 2™! When serious hardware problems occur, nothing gets you up and running as fast. KickStart 2 measures power within 2.5% on all four voltages, shows Power-On Self-Test (POST) failure codes, and features on-board ROM-based diagnostics allowing you to determine and remedy the problem quickly, easily, and inexpensively!

Built-in serial and parallel I/O allows for testing remote via modem, or simply logging results to a remote terminal, printer, or laptop. You can configure your own test routines and store them in KickStart 2's battery-backed CMOS RAM for quick future use. On-board switches, LEDs, and digital displays allow complete control over testing in systems lacking video or disk.

KickStart 2 is the ultimate SECURITY CARD, too. With two levels of password protection and pre-O/S activation, you can confidently prevent unauthorized use of your PC.

Includes serial and parallel loopback plugs and the Landmark JumpStart® AT ROM BIOS for testing ATs that don't issue POST codes. KickStart 2 works independent of your operating system. You can use it on DOS or UNIX systems. CALL for current pricing.

THE 5 MINUTE SOLUTION TO FLOPPY DRIVE FAILURE

With AlignIt™ you can clean, diagnose, and align your floppy drives in minutes without a scope. Patented technology requires only a screwdriver to perform ANSI-accurate alignments (.3 mils).

AlignIt is ideal for corporate users with multiple PCs. The GOLD STANDARD feature allows you to align all your PCs to the same in-house standard, guaranteeing that all your floppy drives are perfectly interchangeable between PCs! Available in 3.5" or 5.25" for both high and low densities. CALL for current pricing.

PROFESSIONAL LEVEL PC TROUBLESHOOTING

Landmark Service Diagnostics™ is ideal for professionals requiring the most exhaustive diagnostic test capabilities.

Service Diagnostics is not just a single product, but a complete LINE of products. It's comprised of software, hardware, and firmware so you can choose the best "tool" for the job.

When your PC won't boot, you'll need ROM POST firmware, a plug-in chip that virtually "jumpsstarts" the system to determine what's wrong. And, when your printer isn't working, you won't know whether it's the LPT port, cable, or printer without hardware, like our loopback plugs (which together with our software completely test the COM ports).

To provide you a complete troubleshooting resource, Service Diagnostics is offered in single modules or in "kits." Components include: CPU-specific software (PC, XT, AT, 386/486, PS/2), ROM POSTS (PC, XT, AT) and floppy alignment disks (3.5" and 5.25").

All the Service Diagnostics software modules are available in self-booting versions for use with non-DOS operating systems like UNIX.

Service Diagnostics is powerful and flexible. Hundreds of tests can be performed on your motherboard, memory, video, COM ports, floppy and hard drives, printer, and more. CALL for a customized quote on the kit that's right for you!

SLASH HARD DISK SET-UP TIME

If you install, upgrade, or maintain hard drives, then you need DiskBase™. It'll save you boat-loads of time and money by putting the exact hard disk information you need at your fingertips... whenever you need it.

DiskBase reveals 12 technical specs on over 2500 hard disk drive models and 8 technical specs on over 220 controllers. Once you've located the correct hard disk model, you can instantly bring up a listing of all compatible controllers. CALL for current pricing!
Three unusual CD players debuted in 1992: Sony’s MMCD Player, Tandy’s VIS (Video Information System), and Philips’ CDI 360 Portable. Each uses a different processor, operating system, and CD format (see the table). The common threads are CD-ROM and NTSC output. These three specialized CD appliances are all equipped to play on your TV.

The VIS, restricted to that mode, most clearly targets the home market. VIS applications use a Windows derivative called Modular Windows, which presents a simplified interface on a TV screen and takes user input from an infrared remote control. Developers will use familiar Windows tools to create VIS applications and can readily port MPC titles to the new platform. Owl International (Bellevue, WA) and AimTech (Nashua, NH) have announced authoring tools to support the VIS.

Initially, the VIS CD-ROM drive supports neither single-session nor multisession Photo CD. However, the VIS is eminently upgradeable, with sockets for a video accelerator and a modem. “It’s the most open-architecture computer out there,” says Richard Doherty, editor in chief of the multimedia newsletter Envisioneering (Seafood, NY), “but Tandy will say, No! No! It’s not a computer, it’s an appliance!”

The Sony and Philips players, which can connect to a TV or run stand-alone, double as entertainment or educational appliances and as business tools. Newsweek’s recently announced Newweek Interactive, a quarterly CD-ROM version of the magazine, will showcase the MMCD Player as a home entertainment device. Northern Telecom’s new diagnostic application for PBX systems will put the MMCD Player to work. The company’s 3700 field technicians will soon be able to connect the Sony unit’s serial port to PBX switches, run diagnostic software, and hotkey to a 30,000-page store of searchable documentation.

Philips’ CDI 360 can also play in both consumer and business markets. The company is marketing CD-I as a better platform than CD-ROMXA for integration of audio, video, text, and graphics. An alliance between Dataware Technologies and Philips subsidiary OptImage brings the data-crunching capability of traditional CD-ROM retrieval software to the sight-and-sound world of CD-I.

Although the MMCD Player’s use of the CD-ROMXA format theoretically enables it to share titles with ordinary PCs that have XA drives, there are obstacles. Most XA drives sold today don’t come with the hardware support (ADPCM [Adaptive Differential Pulse Code Modulation] decompression and deinterleaving) that Sony’s embedded XA chip set provides. Also, the Sony unit’s small display and lack of a hard drive make it incompatible with current XA-based PC applications.

For Philips, the cost of CD-I hardware and development tools is an impediment, as is the royalty the company charges for use of the CD-I name. “When you say ‘CD-I,’ you are mentally writing a check to Eindhoven [the Netherlands base of Philips Electronics NV],” says Doherty, “and that rubs a lot of people the wrong way.”

Ed Perratore is a BYTE news editor based in New York. You can reach him on BIX as “eperratore.”
The Worlds First Universal File Editor
Edit Any Text/Data/Binary File Up To 2 Gigabytes

- Unique multi-mode, multi-file editor handles any text, data or binary file.
- Edit DOS, Unix and Mac text files, fixed and variable length data records.
- Edit in ASCII, Hexadecimal or EBCDIC, or combination of modes.
- Edit database, mainframe, Postscript, .EXE and other non-standard files.
- Hyper-browse CD-ROM files.
- Full featured program editor.
- Convenient word processing.
- Also VEDIT for only $89.

Until now, data files, such as database files, downloaded mainframe files, Postscript and plotter output, .EXE executables and other non-standard files were a real headache if you ever had to view, patch, search, search/replace or extensively edit them.

Traditional text editors can't handle these files because they are non-standard or too big. Traditional disk utilities allow only the most primitive viewing and patching. Just a single corrupted data file could take days to fix, and you sweated and cursed the whole time.

A new way to handle data files

VEDIT lets you edit data files as effortlessly as text files. Its secret is incredible speed, huge file capacity and special editing modes.

File modes support DOS, Unix and Mac style text files plus data files with fixed length or variable length records. Display modes include five ASCII modes, Hexadecimal and EBCDIC, or split the screen for any combination. Search using pattern matching or regular expressions, cut and paste data files, and much more. Long lines can be horizontally scrolled or wrapped onto multiple screen lines.

Handle nasty "text" files too

Text files may sound easy to edit, but other editors choke when they hit embedded control (null) characters, very long lines or the 400 Megabyte file you are trying to put onto a CD-ROM. VEDIT handles all text files effortlessly and automatically detects the correct file type. With VEDIT you can conveniently edit any file you will ever encounter.

Speed, speed, speed

Only VEDIT has the speed to edit multi-megabyte files. Traditional text editors such as Brief(tm) and Sage(tm) are much too slow to edit files much larger than memory; and Multi-Edit(tm) is 7 times slower than VEDIT. And none of them can efficiently edit data files.

<table>
<thead>
<tr>
<th>Feature</th>
<th>VEDIT</th>
<th>Brief</th>
<th>Multi-Edit</th>
<th>Sage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit data/binary files</td>
<td>Yes</td>
<td>No</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>Support fixed/length records</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Maximum line length</td>
<td>Unlimited</td>
<td>512</td>
<td>2048</td>
<td>65K</td>
</tr>
<tr>
<td>Maximum file size</td>
<td>2000 Meg</td>
<td>32 Meg</td>
<td>32 Meg</td>
<td>100 Meg</td>
</tr>
<tr>
<td>Hex/EBCDIC editing</td>
<td>Yes/Yes</td>
<td>No/No</td>
<td>No/No</td>
<td>No/No</td>
</tr>
<tr>
<td>Multiple display modes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Fast browse of CD-ROM</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Global search/replace</td>
<td>In 10 Meg file</td>
<td>2:49 min &gt;24 hours</td>
<td>20.0 min</td>
<td>2:10 hour</td>
</tr>
</tbody>
</table>

Ultimate programmer's editor

Long a favorite among programmers, VEDIT has every advanced feature you might expect. Simultaneously edit numerous files, split the screen into windows, search/replace with regular expressions. Automatic indent, block indent, parentheses matching and block operations by character, line, file or column speed program development. Word wrap, paragraph formatting, justification, and many printing options are ideal for text processing.

Its unique compiler support integrates tools from different vendors and fully supports 'make'. VEDIT PLUS has the most powerful macro programming language of any editor. It's ideal for translating files from one format to another.

Easy to learn, easy to use

An intuitive user interface with drop down menus, hot keys, mouse support, optional scroll bars, context sensitive help, point and shoot file selection and unlimited keystroke macros make VEDIT PLUS easy to use, easy to learn. Safety features include 1000 level undo, auto-save and optional backup files.

The entire keyboard layout and everything in VEDIT is configurable with easy to use menus. With over 100 configuration parameters you can fine-tune VEDIT to your exact needs and preferences.

Installation is trivial. Only the 85K VEDIT.EXE is required (no overlays) and a full installation is only 500K.

FREE Fully Functional Demo!
Call 1-800-45-VEDIT

Confidently order your VEDIT PLUS today; it comes with a 30 day money-back guarantee. VEDIT has been the choice of 100,000 programmers, writers and engineers since 1980.

VEDIT PLUS - DOS single user license: $185; DOS network 5 user license: $385; UNIX/XENIX, QNX, FlexOS/IBM 4680: $285.

A new, fully functional demo of VEDIT PLUS and a shareware VEDIT Jr. are available on our BBS at (313) 996-1304.
And for good reason. Because CompuAdd Express is the only one that can bring you everything you ever wanted in a color notebook—for just $2,795. And we mean everything. Because the Express 425Color has a 25MHz 486 processor, built-in trackball, built-in fax/modem, 8MB RAM, 120MB hard drive and a capability for more effective presentations. And you get all this for just $2,795.

How can we do it? Because at CompuAdd Express, we focus our energy on our customers and their needs. That's why we offer the CompuAdd Express Guarantee, an outstanding combination of services.

We Think We Just Heard A Collective Groan From Our Competition.

passive matrix 640x480 display. So your graphics pop, your Windows icons and command boxes will be easier to use and all your applications will be more enjoyable. Plus, you can take advantage of simultaneous display and support no buyer should be without. And you can buy from us with confidence, because we're a spin-off of CompuAdd, the company that pioneered direct marketing of computers 10 years ago. As a result, our Tech Support staff averages more than five years experience, and our Customer Service staff averages more than nine. So we know what we're talking about. And we're ready to help. With this impressive combination of technology, engineering, service, commitment and low price, it's no wonder our competition is groaning. And no wonder our phones are ringing. Because when you're looking for the best value, it all adds up to CompuAdd Express.

Standard With Every CompuAdd Express System

- 30-day money back guarantee
- Express 30-day exchange
- One-year limited warranty covering replacement or repair of defective hardware
- Rapid repairs
- Toll-free technical support
- Remote Rescue online technical support
- Technical bulletin board service
- The convenience of Express Leasing
- Easy credit when you have an Express credit card

We accept MasterCard, VISA, CompuAdd Express Charge, money orders, certified checks (please allow ten days for processing), CODs (minimum order $50), company and institutional purchase orders (minimum initial purchase $25), returns $50 with approved credit) and wire transfers. Shipping charges are calculated according to weight and distance. Texas residents, please add appropriate local sales tax. CompuAdd Express will replace or repair defective hardware, software and consumable items. A 15 percent restocking fee may be charged. All returned items must be accompanied by a return merchandise authorization (RMA).
Cyrix CX486SLC processor rated at 25 MHz

120MB hard drive.

Presentations are easy with the 425Color's simultaneous display. Use the external VGA video connector to display data and graphics on your notebook and a full size monitor at the same time.

Passive matrix LCD display with 640x480 resolution. Measures 8.5" diagonally.

Built-in 9600 baud fax/2400 baud modem, both with send/receive capability.

Built-in mouse trackball with 200 dots per inch resolution.

Drawer makes adding a coprocessor easy.

The total system weighs only 6.3 pounds— including battery.

Click buttons are on the side.

Measures 8.5"x11.5"x2". Chassis has a suede texture finish.

Express 425Color Notebook

Lease for only $103/mo.

Express 425XL Notebook

- Cyrix CX486SLC processor rated at 25 MHz
- Over 3 hours of battery life (depending on application, individual use and power management)
- Math coprocessor socket in drawer for easy access
- Super-twist backlit liquid crystal display
- Display: 8.5" usable diagonally
- 64 levels of grayscale
- 9600 baud fax/2400 baud modem
- FREE Bit-Fax software
- 120MB IDE hard drive
- 1.44MB 3.5" internal floppy drive
- Only 6.3 pounds including battery
- FREE Windows 3.1, MS DOS 5.0, LotusWorks 3.0, Close-Up 4.0, a free international adapter and carrying case— OVER $600 VALUE!
- 4MB RAM upgradable to 8MB
- Built-in mouse trackball
- Serial and parallel ports, PS/2 keyboard connector
- External VGA video connector for simultaneous display

$1,995 Lease for only $73/mo.

Charge batteries three ways—in notebook while you're using it; in the notebook while you're not using it or in our optional battery charger (charges two batteries at once).

The 425Color warns you two ways when its battery is low—with a beep and a blinking light.

8MB of RAM

Display controls are beside the screen on the right.

Standby button shuts down display and drives when you close the lid but preserves data.

Power switch located on the keyboard surface.

84-key layout implements the functions of a standard 101-key keyboard.

The inverted "T" configuration for arrow keys is conveniently located.

A 1.44MB 3.5" internal floppy drive.

FREE Windows 3.1, MS DOS 5.0, LotusWorks 3.0, Close-Up 4.0, international adapter and carrying case— OVER $600 VALUE!

Call to order or to request a free catalog.

CompuAdd Express

800-925-3525

12301 Technology Boulevard
Austin, Texas 78727

Hours: 8am-6pm (CST) M-F
512-219-1800 Fax 512-219-2890

number. CompuAdd Express sells and services equipment within the United States only and will pay no customs, duties or tariffs on returned merchandise. Prices and product descriptions are subject to change without notice. CompuAdd Express is not liable for damage due to omissions or typographical errors. A copy of our limited warranty is available prior to sale from your sales representative. Pre-installed MS DOS 5.0, Windows 3.1, LotusWorks 3.0 and Close-Up 4.0 are OEM versions.

Circle 71 on Inquiry Card.
impressive sales pitch by jazzing up the content with sound and video.

For governments, a compelling use of CD-R will be to satisfy requests for information. Conventional CD-ROM publishing has already improved matters tremendously. Topographical and geological survey data used to cost $100 per 9-track tape. Now you can get it on CD-ROM for $32, says George Knapp, a USGS abstracts editor and chairman of SIGSOFT, a group that evaluates CD-ROM authoring and retrieval tools. “For public access to data,” he says, “CD-ROM is the greatest thing that’s ever happened.”

The Office of Business Analysis in the U.S. Department of Commerce (Washington, DC) publishes the National Trade Data Bank on a CD-ROM that amalgamates import/export data, marketing studies, and foreign-aid program information from 15 federal agencies. The disc helps U.S. exporters understand international markets. A second title that delivers U.S. economic, social, and environmental data will soon be available.

CD-ROM discs produced under federal auspices are almost always replicated, even if they’re ultimately sold only in small numbers, because copies must be distributed to the federal depository libraries—a group of some 1250 university and public libraries that agree to store federal data issued through the U.S. Government Printing Office. Nevertheless, there is a need to publish individual discs on demand.

Daniel Costanzo, a physical scientist with the U.S. Army Topographic Engineering Center (Pt. Belvoir, VA), expects that customized slices of topographical data that today ship on 9-track tape will eventually be delivered on CD-ROM discs. There’s also an argument in favor of publishing some kinds of widely distributed data on demand. “If you print 10,000 CDs of GIS [geographic information system] data, it’s like printing 10,000 maps,” he says; “the currency deteriorates over time.” In cases where demand-published CDs are feasible, users will always get fresh data.

The nature of that data will determine how well such a model works. Satellite and sonar images, which are just collections of files, are easy to dump to a disc. In the case of text or fielded data, however, the need to index the material will make it harder to carve out and deliver unique subsets.

**Publisher Profiles**

For CD-ROM publishers, testing discs prior to mass production was a complex ritual before CD-R. An emulator like Meridian’s CD Publisher could make a hard disk–based ISO 9660 “image” written by an authoring tool look like a CD-ROM to the retrieval software. Such emulators can artificially slow access to the hard disk to help you gauge what the actual CD-ROM performance will be.

But one person sitting at the emulator’s console can’t fully explore the vastness of a disc and ensure that hundreds of megabytes of data have been properly assembled. For that, you need to make discs that can be distributed to a team of testers equipped with ordinary, inexpensive players. Suppose you need 10 such discs. Producing them by conventional means might entail a minimum order of $100, cost $1500, and take three to five days. The CD-R solution, by contrast, yields just the 10 discs you need, for about $300, in one day. “After you’ve gone around that track a few times,” says Bill Harlow, a marketing manager at Philips Consumer Electronics (Knoxville, TN), “our drive has already paid for itself.” On a tight deadline, the rapid turnaround of CD-R—for which mastering houses may double their fees—can be a critical factor.

The number of CD-ROM publishers is growing rapidly. Market researcher InfoTech (Woodstock, VT), which has tracked the CD-ROM industry since its inception, reports that last year the number of commercial and in-house titles grew from 3500 to 5000, and the installed base of drives more than doubled, to over 5 million (see figure 4 on page 132). At the same time, the CD-ROM retail market experienced dramatic change, according to the Bureau of Electronic Publishing. In 1991, fewer than 20 percent of the 17,000 computer-related retail outlets in the U.S. carried CD-ROM products. Last year, 80 percent did.

The Library Corp. (Inwood, WV) helps public and university libraries merge their own collections data with general sources such as indexes of periodicals, thereby creating custom titles unique to each library. Conventional replication is the technique of choice for bigger customers, such as the St. Louis Public Library, which has 141 networked readers. But CD-R is The Library Corp.’s ace in the hole for clients like Texas Christian University, which needs only a single disc.

Donnelly Marketing Information Services (Stamford, CT) makes CD-ROMs for market researchers. DMIS’s director of software development, Mike Herman, says his company is investigating ways to create “onesie-twosie” discs for clients who want to merge their own data with the DMIS data. For Herman, the human cost of producing custom discs is by far the biggest issue.

At Hub Data (Cambridge, MA), a publisher of financial data on CD-ROM, CEO Bob Huesbacher views CD-R as a way to deliver incremental updates to his monthly product. Huesbacher sees the cost of CD-R blanks as a bigger obstacle. “I wouldn’t think twice about a $2 disc,” he says, “and I’d consider $10, but the current
and start examining the brilliant, sharp image of our 17" Optiquest 4000D. With its Invar Shadow Mask, you can display color intensive images that are razor sharp and 20% brighter than conventional monitors. Its flat, square screen offers a consistent overall, edge-to-edge image with reduced distortion at the corners. Higher refresh rates permit a flicker-free picture, and microprocessor controls allow 28 preset modes while adhering to strict Swedish MPR II low radiation standards. Your eyes will appreciate 36% more viewing area than 16" displays along with a non-glare screen and 1280 x 1024 resolution. And all this at a sensible price. So, if image quality at .28 dot pitch and 76Hz refresh rate meets your standards, stop looking and start dialing (800) 843-6784. Ask about our award winning 2000D 15" flat, square screen, too.
Once and Future Standards

A flurry of emerging standards swirls around CD-ROM and CD-R. For starters, there's a new "color book" on the horizon. The Crayola box of CD standards (see figure A) has for some years included Red Book (CD audio), Yellow Book (CD-ROM), and Green Book (CD-I). (CD-ROM XA doesn't rate its own color; it works within Yellow Book's free-form mode 2 sectors.) Now there's Orange Book, which governs MO (magneto-optical) and CD-R drives. Part 1 of Orange Book defines a CD-ROM/MO hybrid. Part 2 defines single-session and multisession CD-R, and it is the subject of much current confusion.

Because the specification isn't nailed down, true Orange Book devices don't exist yet. Among CD-R drives, the Philips CD21 follows Orange Book most closely, although Philips admits a drive bought today might need a firmware upgrade next year. Sony has chosen to wait for a final specification before building multisession support into its CDW-900E. Alan Sund, Sony's (San Jose, CA) marketing manager for CD-ROM drives, says, "We're not going to have a compromised product claiming to follow a standard that doesn't exist."

Meanwhile, vendors of CD-ROM players—including Pioneer, Toshiba, Philips, and, yes, Sony—are scrambling to make their drives work with multisession Photo CD discs. Kodak, too, is betting that its own Photo CD player won't become obsolete by some last-minute change in the specification.

Why the confusion over multisession CD? Early developers of CD-ROM never anticipated CD-R. Users would read CD-ROMs, not write them, and a single session that could hold oceans of data hardly seemed limiting. (In retrospect, the handwriting was on the wall. From the beginning there were "mixed-mode" discs that combined file-system data and audio tracks.)

Those same assumptions led to the ISO 9660 file system, which is both a great strength of CD-ROM and an increasingly troublesome limitation. ISO 9660's strength lies in its unique status as an operating-system-independent file system. An ISO 9660-formatted disc works identically on a PC, a Mac, or a Sun workstation. The disc may include operating-system-specific versions of a retrieval application, but each of these will access a common set of files. However, ISO 9660 is a least-common-denominator file system: It sacrifices features of the Mac (e.g., icons and resource forks) and Unix (e.g., symbolic links and permissions), and it doesn't permit updates.

There are two ways to make richer CD-ROM file systems. One is to make a non-ISO 9660 CD that uses a native Macintosh or Unix file system. That works, but performance can suffer since these file systems require special tuning for slow media. Also, you lose the vaunted interoperability of CD-ROM.

A second approach is to wrap operating-system-specific extensions around an ISO 9660 core. The Unix version of this technique is the Rock Ridge protocol, a compatible superset of ISO 9660. Unix systems equipped with the Rock Ridge extensions see a CD-ROM in Rock Ridge format as a Posix file system, complete with long filenames, permissions, and symbolic links. Other systems see the same collection of files as an ordinary ISO 9660 namespace. JVC Information Products' (Huntington Beach, CA) Personal RomMaker applies the same concept to the Macintosh. Its hybrid HFS/ISO 9660 mode makes discs that look like Macintosh volumes to Mac users but work for DOS and Unix users as well.

On the drawing board is a specification for a new CD-ROM file system. Known informally as the Frankfurt specification (officially, standard 168 of the ECMA [European Computer Manufacturers' Association]), it promises equal enrichment for Unix, Mac, OS/2, and Windows NT. Working hand-in-hand with Orange Book, Frankfurt will also support the incremental update capability that ISO 9660 designers never thought would be needed. The Orange Book/Frankfurt combination promises to make tomorrow's CD-R systems as easy to update as today's WORMs, while elevating the cross-platform CD-ROM standard to meet the needs of modern operating systems.

The catch? Everything breaks. Drives will need firmware upgrades, and no current CD-ROM software infrastructure will carry over to Frankfurt discs. That's why Young Minds' (Redlands, CA) president Andrew Young says of the Rock Ridge extensions he invented: "We're solving a today problem. Frankfurt solves a tomorrow problem."
$25 just isn’t in the ballpark.” The frequency of publication combined with high media cost would shrink Hub Data’s profit margins.

Not much can be done about the labor cost of CD-R production, although some drives (e.g., Sony’s) can be used in parallel to produce multiple copies at a time. Media costs are falling, however; the only questions are how far and how fast. Eastman Kodak (Rochester, NY) predicts $10 blanks in a few years. Is that likely? Much depends on the success of Kodak’s Photo CD, a new imaging process that is the granddaddy of all CD-ROM applications. (Kodak writes Photo CD discs using the Philips CDD 521 drive.) Photo CD could be the engine that drives CD-R, just as audio CD-powered CD-ROM. Moving just 1 percent of the film images processed each year into Photo CD format would create 5 million custom discs.

CD-ROM has also become a popular vehicle for software distribution. “We don’t have final numbers yet,” says InfoTech researcher Deborah Barlow, “but I won’t be surprised if the number of discs used for software delivery exceeds those published for sale as commercial titles.” Sun Microsystems, Hewlett-Packard, and Apple have long used CD-ROM to deliver software, but this year has seen many new entrants, including IBM (OS/2), Microsoft (Windows NT), and Borland International (Borland C++). Windows NT alone, still in prerelease, has already shipped on CD-ROM to 20,000 software developers.

The U.S. government is keeping pace with this trend as well. Allan Betts, CD-ROM production chief at the National Technical Information Service (Springfield, VA), says that the U.S. government produced 2,000 titles last year, and he predicts rapid future growth. Betts, who advises dozens of federal agencies on CD-ROM production, says that one of the pressing plants his clients use now gets more than half its input in the form of CD-R discs rather than the traditional magnetic tapes.

Another segment builds multimedia titles for MPC, CD-ROM XA (Extended Architecture), and CD-I (Compact Disc Interactive) platforms (see the text box “The New Breed of CD Players” on page 124). The authoring tools these publishers use differ from the ones that create conventional titles, especially when the target is an XA or CD-I player that expects a mode 2 format, incompatible with the mode 1 format of conventional CD-ROM (see the text box “Once and Future Standards” on page 130). But these distinctions exist purely at the logical level. To a CD-R drive, it’s all just bits. Users of Mammoth Micro Productions’ (Golden, CO) Studio/XA or OptImage’s (West Des Moines, IA) MediaMogul test their XA and CD-I titles on the same CD-R drives that Dataware Technologies (Cambridge, MA) or Silver-Platter (Norwood, MA) customers use to develop standard CD-ROMs.

Manage Your Assets

As CD-ROM technology grows more practical, companies often find that they’re unprepared to meet the challenge of what the OPA’s Bowers calls “enterprise publishing.” According to Bowers, CD-ROM has catalyzed a whole new view of the corporate information asset. “When you shift to this view,” he says, “you suddenly find your whole structure [the way corporate data is stored] is upside down.” Text kept in a random assortment of folders, tagged haphazardly or not at all, won’t easily flow into a structured, possibly hyperlinked CD-ROM application.

Endors of authoring and retrieval tools—including Fulcrum, Verity, and Personal Library Software—use fuzzy search and relevancy techniques, as opposed to standard Boolean searches, to minimize the need for structure. Fuzzy searches look for an approximate match; for example, a search for the word war might also turn up references to conflict or battle. Relevancy examines the context of the retrieved text to determine the most appropriate hits.

Such products also support fields, however. Structure married to sophisticated full-text search capability is the most powerful combination. Electronic Book Technologies’ (Providence, RI) DynaText exploits that combination in a striking way: When you do a search, it distributes the hits across the table of contents, so you can see at a glance which are the relevant chapters or sections. Thus, instead of getting hits on a per-document basis, you see how they relate to structure internal to documents.

How do you put in the structure? A consensus is rapidly emerging: SGML (Standard Generalized Markup Language). SGML is an extensible system for describing the structure and style of richly formatted documents (see “SGML Frees Information,” June 1992 BYTE). Like many government-mandated standards, it bores the average person to tears. However, it is clearly the right way to manage text for dual use—that is, for simultaneously print and electronic publication. That’s why both Novell and Silicon Graphics recently decided to migrate their documentation from proprietary formats to SGML. Avalanche Development (Boulder, CO) and Exoterica (Ottawa, Ontario, Canada) offer SGML conversion tools. Dataware Technologies’ CD-HyperText, which natively comprehends SGML, is an authoring tool that the company used to build a hyperlinked CD-ROM version of the U.S. tax code.

Another strategy for text is Adobe’s Acrobat. Acrobat builds on two core technologies: Adobe’s Multiple Master fonts, which can emulate the metrics of virtually any font, and a “reduced instruction set” PostScript that compresses files to a fraction of their normal size. The architecture includes a file standard, known as PDF (Portable Document Format), and software to convert

**Figure 3:** CD-R production pays as long as the number of copies stays relatively low. Conventional CD-ROM duplicators charge about $1500 for 100 discs; that rate can double for one-day turnaround. At $40 per disc, CD-R is cost effective for press runs of under 35. This chart does not take into account the cost of the CD-R drive or the cost of labor.
PostScript and non-PostScript documents into PDF format. Inexpensive software viewers that allow you to read and navigate PDF documents will be supplied first for Windows PCs and Macs and later for Unix, DOS, and OS/2 systems.

Using Acrobat, you can assemble documents created in a desktop publishing program such as PageMaker and run them through a batch Distiller that converts them to PDFs. Or you can use the PDF Writer to convert non-PostScript word processing files from Word or WordPerfect. Once these documents are written to a CD-ROM or other distribution medium, any system that hosts a viewer application can read them. In fact, viewers customized to read only the documents on a given CD-ROM can even be shipped with each disk. Note, though, that the first release of Acrobat won’t support full text indexing.

The correct dual-use strategy for nontextual data is far less obvious. You can’t just dump a Clipper or FoxPro application onto a CD-ROM disc and expect anything close to reasonable performance against large data sets. While the newer CD players can transfer data at a respectable clip, their slow seek times relative to those of hard disks remain a deadly impediment. Commercial tools like Dataware’s CD Author use a variety of tricks to optimize for CD-ROM: loading B-trees fully (since they can’t grow in a read-only environment), storing indexes as separate files, and exploiting disc geography for best locality of reference. With these techniques, a simple search can take just seconds instead of many minutes.

Complex queries present even trickier problems, however. A SQL query that wanders all over the disc will take a year and a day, and it has no place to write its temporary indexes. Many producers of CD-ROM database products take a radically asymmetrical approach: They anticipate common queries, generate result sets in advance (often represented as bit maps), and write the prepared results to the disc alongside the data. Such preparation, which can take days of processing, gives users the illusion that their queries run almost instantly. Unfortunately, there’s no simple or automatic way to convert a live transactional database into an optimized CD-ROM database.

**Publishing for Posterity**

CD-R clearly threatens WORM as an archival medium, although in the short run WORM’s chief competitor will be MO (magneeto-optical) technology (see the text box “Optical Flavors” on page 134). CD-R’s compelling advantage is that you can read an archived disc in any CD-ROM player.

Creating that disc is complicated by three factors, however. First, you’ve got to translate the source file system (DOS, Mac, or Unix) into the neutral ISO 9660 file system that is the CD-ROM standard. Drives often provide formatters that convert on the fly as they write to the disc, but they may not handle some subtle naming conflicts. Hyphens are legal in DOS, for example, but not in ISO 9660.

Second, you must feed the drive a continuous stream of data. A dual-speed recorder, which fills a disc in a half-hour, needs a sustained 300 Kbps. That’s only achievable from a fast hard disk in a controlled environment. Archiving a network drive must therefore be a two-stage process—one transfer to the CD-R workstation’s hard disk, and then another to the CD-R drive. Finally, you’ll want enough data on hand to justify the use of an expensive piece of media that can hold upward of 600 MB. Most CD-R drives don’t yet support append operations (i.e., multisession recording), and none allow incremental file-oriented updates.

Other issues are the quality and longevity of CD-R media. NTIS’s Betts found a distressing number of uncorrectable errors in early batches of CD-R discs he tested. Admittedly, Betts uses Enterprise Corporation of America’s (West Des Moines, IA) CD-CATS (CD computer-aided testing system) to ferret out tiny defects that might well escape the notice of casual users. Still, “if Reed-Solomon [CD-ROM’s error correction code] won’t read,” he says, “it is by definition not a CD-ROM.” The CD-ROM specification requires functional error correction. Betts adds that the situation is improving rapidly.

Longevity is an open question for both CD-ROM and CD-R media. Since CD-R discs are burned, not pressed, they are more vulnerable to heat. Manufacturers also warn users to handle CD-R discs with greater care than CD-ROMs, implying that they’re more fragile. But assuming that you take reasonable precautions with regard to heat and handling, there’s no reason to think CD-R discs won’t endure for 10 years, 25 years, or longer. It’s even possible they’ll outlast CD-ROMs, says Digipress (Louisville, KY) general manager Denis Oudard, an expert in archival CD-ROM. (His company’s Century-Disc, a specialized $495 CD-ROM made of tempered glass, aims to last hundreds of years.)

"The Achilles' heel of conventional CD-ROM is the aluminum reflective layer," says Oudard; it oxidizes too easily. CD-R discs use gold, which is more stable.

You don’t have to own a CD-R drive to archive your data onto a CD-ROM. If it’s something you’ll need to do only once, you can
We've just made it easier to backup your hard drive with our 250 MB parallel port tape backup unit. One model works with all PC compatibles and portables.

Here's why:

**Backpack** is easy to install. Plug Backpack into the parallel printer port. Then plug the printer into Backpack!

**Backpack** requires no cards.

**Backpack** is 30% smaller (1.5" h x 4" w x 7.75" l).

**Backpack** is easy to transport and share between computers (2.5 lbs).

**Backpack** can backup at a speed of up to 9 MB per minute.

**Backpack** is a QIC 80 compatible and can read QIC 40 tapes.

**Backpack** is available in 3.5" and 5.25" diskette, tape and hard disk models.

So don't get left in the dust. Call for more information today.

Micro Solutions, 132 W. Lincoln Hwy., DeKalb, IL 60115, 815-756-3411, FAX: 815-756-2928
 Optical Flavors

ANDY REINHARDT

CD-R offers a mix of drawbacks and advantages relative to its optical competitors WORM and MO (magneto-optical). With incremental, file-oriented write capability still on the drawing board for CD-R, it loses out to MO and WORM for interactive on-line use. It also loses out on price, with an average drive costing just under $10,000. WORM drives average $3800, while MO drives average roughly $4500. CD-R’s great strength is standardization unmatched by any other form of removable media. Magnetic options such as Bernoulli and Syquest are proprietary, and the WORM market has been plagued by noninterchangeability. CD-R users can rest secure in the knowledge that archived data will be readable on any CD-ROM player.

In the short term, however, it’s MO rather than CD-R that is usurping WORM’s archival role. Researcher Freeman Associates’ (Santa Barbara, CA) vice president Robert Abraham projects that sales of 5¼-inch WORM drives will plunge from 40,000 units this year to almost none in 1997, while 5¼-inch MO drives will grow from 174,000 to 400,000 units over the same period.

Competition for WORM will come from two kinds of “multifunction” MO drives, Hewlett-Packard, Sony, Hitachi, and Maxoptix sell drives that use standard 5¼-inch MO media but allow users to designate certain disks for write-once use only.

Critics charge that by merely emulating WORM, these drives don’t offer the same degree of permanence and security as true WORM. Abraham says some people insist on using only ablative media that record permanently. Responding to that need, Pioneer and Laser Magnetic Storage sell drives that accept the same write-once media as their traditional WORM drives and also read and write 5¼-inch MO disks. Abraham says these drives are a good option for users who insist on true WORM but sometimes want the flexibility of rewritable media.

As CD-R drives and media get cheaper, recordable CD technology is likely to capture a growing share of the archival market. Early applications will have to be batch-oriented, however. "When you write to a CD," says Cris Simpson, an optical memory engineer with Pioneer Communications of America, "you have to lay down a big hunk of data because of the overhead associated with each session." File update capability for CD-R awaits completion, and then widespread acceptance, of the Frankfurt committee’s ECMA (European Computer Manufacturers’ Association) 168 specification.

Where CD-R is not expected to hurt WORM is in the specialized market for high-capacity storage. The only WORM drives Sony now sells are the 12-inch variety, which offer capacities of 6.5 GB and are often packaged in huge jukeboxes. "CD-R doesn’t affect the regular WORM market for us," says Alan Sund, Sony’s marketing manager for CD-ROM drives. "It’s a totally different product and market, a whole different range of capacity."

Andy Reinhardt is BYTE’s West Coast bureau chief. You can reach him on BIX as "areinhardt."

Client-Server CD-ROM

The push for a generic client-server model appropriate for CD-ROM has two motivations. The most critical need is to slow the proliferation of user interfaces that comes with a growing number of titles. My local college library has four CD-ROM stations, each with a different title. Because four different vendors produce those titles, there are four different user interfaces to master.

SFQL (Structured Full-Text Query Language), CD-Rdx (CD-ROM Read-Only Data Exchange), and DXS (Data Exchange Standard) are among the proposed standards that promise just such consolidation. The viewing application will play the role of client, issuing requests to a data source that acts like a server. The benefit to users will be enormous. Unfortunately, only a few CD-ROM tool vendors have yet embraced any of the proposals now on the table. Many more, including Dataware and Silver-Platter, use a client-server model internally and are waiting for a clear winner to emerge.

A second reason for the client-server model is the need for effective remote access to CD-ROM stations. A file-based CD-ROM application usable on a 10-Mbps LAN grinds to a halt when you connect to those files at 2400 bps. A server-based CD-ROM, on the other hand, could communicate effectively with a remote client even over a slow link. I could dial into the CD-ROMs as I dial into my library’s Ultrix-based on-line catalog.

None of these tantalizing future prospects should obscure the central message: Today’s CD-ROM, warts and all, is often the medium of choice not only for commercial publishers but also for many forms of corporate communication. Thanks to CD-R, that choice just got a whole lot easier. The history of personal computing has shown over and over that when a powerful technology appears on the desktop, users seize it and proceed to change the world. Here we go again.

Editor’s note: BYTE news editors Patrick Wauryznik and Ed Perratore, West Coast bureau chief Andy Reinhardt, senior news editors Gene Smarte and Tom Haffhill, and executive editor Rich Malloy also contributed to this article.

Jon Udell is a BYTE senior technical editor at large. You can contact him on BIX as “judeil” or on the Internet at judeil@bytepb.byte.com.
ProTracer. Where the qualities of a laser printer meet the output of a large format plotter.

Laser printers offer so much. Like high quality output, speed, desktop convenience and, of course, a low price. Large format plotters, on the other hand, give you the output size you need for certain drawings and applications. What we've done is pulled all of these features together to create ProTracer™—a personal printer and plotter that produces A, B, and C-size output at an impressive 360 dpi resolution.

FEATURES INCLUDE:
- High performance Canon® inkjet engine
- Fast, Intel i960™ processor—drawings that take over one half hour on pen plotters take as little as five minutes on ProTracer!
- Optional accessories including a new, faster HP-GL® language emulation card, PostScript® language emulation, memory expansion boards, and sheet feeders
- Full vellum capabilities
- Unsurpassed customer service — 60-day money back guarantee, one year warranty, and unlimited technical support

For the bigger picture, call Pacific Data Products at (619) 625-3568, Fax (619) 552-0889.
ZEOS® Freestyle/SL.
More features at a lower cost than any other notebook.

To try and compare the new ZEOS Freestyle/SL to any other notebook is next to impossible. Because nothing else has all its features. And even with all these great features, nobody can match the price. Features and price. It would seem the new ZEOS Freestyle/SL is the best of all worlds. It is.

DESIGNED BY USERS. JUST LIKE YOU!
We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power and great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

SL POWER. SL BATTERY LIFE. 64K CACHE!
We listened well.
Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.
And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be quick-charged when the system is not being used or trickle-charged when in use. So what happens when the power is on?

GREAT VIDEO TOO.
You get great video! Because for video control, we chose the amazing new Cirrus Logic VGA controller. It not only consumes less power, it also produces the fast crisp images you’re looking for. And with a business machine like this you’ll also appreciate our dual display capabilities. You can connect an external VGA color monitor for simultaneous display. And that’s not all.

A NOTEBOOK KEYBOARD YOU’RE GOING TO LOVE.
We re-designed and re-sculpted every key from scratch. Even the key-switch mechanism was invented anew. And we added the mouse key for easy cursor control. It is the absolute perfect notebook keyboard. What else?
Lots else! Like the best display system of any notebook available anywhere. We listened here too. The screen is big and easy to read. Plus, it’s high contrast and it’s fast. It’s also very easy to adjust. People said contrast and brightness knobs were hard to use. So we replaced them with soft touch buttons that electronically adjust screen settings at your command. Then we really got creative.

THE ONLY NOTEBOOK WITH A TILT & SWIVEL DISPLAY.
Can you imagine your desktop PC without a tilt and swivel display? Neither could we. So why not incorporate that feature into a notebook. With the ZEOS Freestyle/SL notebook you can adjust the screen left and right as well as tilt it up and down. Now you can truly adjust your notebook screen to the perfect viewing angle.

IT FLOATS TOO.
And then there is the “floating” screen. When you’re facing your new ZEOS Freestyle/SL, the screen actually appears to “float” in the air in front of you. It’s the only notebook that can really be used sitting on your lap!

EXTRA, EXTRA, EXTRAS. READ ALL ABOUT ‘EM!
We’ve made more options available than ever before. Like our modem with send/receive fax. And memory up to 20MB, hard drives to 180MB, even an optional Italian leather carrying case! Extra batteries and a charging stand are available too. Call 800-554-5226 for all the details.
Built-in mouse key provides easy cursor control. Leave those bulky mice behind!

This sliding port door won't break off or come loose. Saves your fingers too.

**ZEOS. #1 RATED NOTEBOOKS, SERVICE & SUPPORT!**

*PC Magazine* recently surveyed notebook users for their Service and Reliability issue. Their findings? “Only ZEOS portable PCs achieved significantly higher-than-average ratings in all four categories.” The categories were reliability, future purchase plans, repair service satisfaction and technical support. And remember, ZEOS technical support is 24 hours a day, 365 days a year, toll free. And we back your new ZEOS Freestyle with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

**ORDER YOUR AMAZING ZEOS FREESTYLE/SL NOW.**

Ordering your new ZEOS notebook is easy. Simply pick up the phone and give us a call. A friendly ZEOS Systems Consultant is ready to answer any questions you may have. You’re going to love your new ZEOS notebook. Give us a call!

**CALL NOW TOLL FREE: 800-554-5226**

---

**NEW ZEOS FREESTYLE/SL ONLY $1895**

- Intel 25MHz 386SL, 64K cach
- 2MB RAM standard, expandable to 20MB.
- 60MB hard drive, options to 180MB, 3.5” 1.44MB floppy.
- Backlit 9½” VGA display with Tilt/ Swivel base. Simultaneous display with external VGA monitor.
- Snap-in and -out battery packs provide for a real 3-4 hours of typical operation or even longer depending on your applications.
- Quick-charge in little over an hour with the small lightweight AC adaptor.
- 8.5” x 11.2”, 5-6 pounds, built-in soft carrying handle.
- 81-key keyboard with built-in full-size inverted “T” arrow keys.
- Serial, parallel and VGA ports with standard connectors protected by a durable, easy-to-use sliding door. No more broken doors or broken fingernails!
- Loads of options. Modems, carrying cases and more!
- Designed and built by ZEOS right here in the USA.
- 24-Hour-a-Day Toll-Free Telephone Support, 365 Days a Year.
- Upgrade Packages Too: Call for details about absolutely loaded systems featuring more memory, bigger drives and Windows.

**ORDER NOW TOLL FREE:**

**800-554-5226**

Fax Orders: 612-633-1325
Government: 800-245-2449
Hearing Impaired (TDD)
Orders: 800-228-5389
Outside US and Canada:
612-633-6131
MasterCard, Visa, Discover, Am Exp, Z-Card.
Open 24 Hours a Day, 365 Days a Year

---

Purchase orders from Fortune 1000 companies, governments and institutions are subject to approval. Leasing programs are available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. All products and company names are trademarks or registered trademarks of their respective holders. ©1992 ZEOS International, Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS). X202-BYT-0302

Circle 149 on Inquiry Card.
“Do Maynard® MaynStream® cartridge tape systems really have capacities up to 1.3 GB and transfer data up to 36 MB per minute?”

“Yes.”

“I understand they come with software that supports DOS®, Microsoft® Windows, OS/2®, and NetWare® NLM?”

“Yes.”

“And for a limited time you’re offering the high-capacity MaynStream 1350Q at up to $1,000 off suggested retail price?”

Enough said.

For your free Networking Disaster Prevention Information Kit or the Maynard dealer nearest you, call 1 800 821-8782.
Is ITV Here to Stay?

ITV brings new information services into your home, but first it must survive

CARY LU

Interactive TV (ITV) bridges the gulf between your computer and your TV. You can exchange information with a control center through a small computer (known in the trade as a black box) attached to your TV. The control center's computer reacts to your input by changing the image on your TV screen.

You can interact with various services. For example, you could compete against TV game show contestants, request further information about an advertised product, tap into a pay-per-use database of up-to-the-minute financial information, or buy a new computer from a mail-order outlet. ITV systems can give you cost-effective, on-demand news, weather, and financial data (see the screen on page 140).

But ITV's detractors question whether it holds any significance for computer users. Many note that ITV's debut comes on the heels of a long list of failed products in related genres. "We are very interested in being the conduit for whatever services the market will pay for," observes Mike Schwartz, vice president for communications at CableLabs, the cable TV industry's R&D arm, "but a lot of our companies were hurt by the earlier versions of two-way television; people didn't buy them."

ITV's proponents argue that the potential ITV market is far larger than that for similar services delivered to a computer by on-line systems. They are convinced that people don't want to learn how to use a computer, preferring instead the familiarity of a TV. "It's easier for people to relate to their TV than to relate to a computer," asserts Paul Sturiale of TV Answer, a start-up ITV company in Reston, Virginia.

To reinforce their product as a TV add-on, several ITV companies downplay any similarities between their black box and a computer. "Our marketing [department] will never say that it is a computer," says Laurence Kirsch, TV Answer's director of user-interface design. "The computer in your office you have to use. A TV product you want to use," he adds.

Sending Signals

The first major hurdle ITV system operators must overcome is how to get a signal from their control center to you. Three major distribution methods are available: radio or TV broadcast, cable TV, and modem (see the figure on page 142).

Operators can broadcast their signal at a variety of places in the spectrum: on a subcarrier of an FM radio station, in the black bar between TV frames (known as the vertical-blanking interval, or VBI), or on a specially assigned frequency. The FCC has already allocated the 218- to 219-MHz bandwidth to
IS ITV HERE TO STAY?

ITV, to be split between two services (with 0.5 MHz each) in every city.

FM radio broadcast and VBI techniques generally are limited to 9600 bps for all activities. Because several activities occur simultaneously, the bandwidth is low, and for short bursts, a single activity can take over the entire bandwidth.

Information transmitted via radio and VBI is limited to text, graphics primitives, and information for positioning an object on-screen. With graphics primitives, the outbound ITV signal instructs the black box to place a circle of any size, position, and color on-screen. The black box takes care of the details necessary for generating each pixel of the circle.

None of the broadcast systems can supply photographic images. Graphics and color are limited to simple objects. This restriction means that if you are shopping for a computer, you cannot browse through pictures of computers.

Most ITV broadcast systems can be distributed through cable TV links. Some ITV operators place the outbound signal in the 4-MHz gap between TV channels 4 and 5. Others dedicate one or two video channels to sending data. An ITV system with its own video channel on a cable system can send photographic images, provided that the black box has sufficient memory to store an image. Full-motion video is technically possible but not practical on a dedicated channel, since everyone using the ITV service would have to watch the same image.

Older cable systems are limited to 36 or fewer channels, so, typically, they can't devote free channels to ITV. However, new developments may change all that. For example, many cable companies are replacing older cable with wider-bandwidth coaxial cable that can support about 150 channels. Some companies plan to install fiber-optic cables that can support hundreds of channels. Still others expect to transmit premium programming using a digital-compression scheme that will support several full-motion images in the 6-MHz bandwidth now monopolized by a single analog TV channel. However, the initial cost of the decompression hardware—expected to be in the hundreds of dollars—may restrict its use to premium services.

Assuming there will be extra channels, how will that capacity be used? Not necessarily for ITV, according to cable companies. The most common answer is that extra channels will support multiple feeds of blockbuster movies. A movie will be fed to multiple channels, with staggered starting times. You could choose a convenient starting time, take an intermission, and resume viewing on a later feed.

For interactive full-motion video, the basic architecture of cable TV has to change. Simply adding fiber-optic cables won't be enough; the signal-distribution system has to switch separate video feeds for each interactive customer. Today, most cable systems feed the same signal to each subscriber. Even fiber-optic cables may not have sufficient bandwidth to support thousands of customers pursuing different activities; therefore, at least part of the cable bandwidth needs to be wired in a style like that of the telephone system, with a separate feed to and from each house.

Telephone-based ITV can take the form of a traditional modem link. Present modem protocols limit speeds to 19.2 Kbps. On a standard twisted pair of copper wires, telephone companies already offer 56-Kbps digital telephone links or a 64- to 128-Kbps ISDN link, but few sites are set up for such services today. The V.34 protocol standard, which should be nearing completion by the time you read this, will improve on current modem protocol speeds, but it will not achieve ISDN data transfer rates.

The maximum carrying capacity of twisted-pair cables is much higher, so data rates of more than a megabit per second or a single full-motion-video channel are possible. A video dial tone would let you send instructions as to what you want to see. The images would appear in full motion on your TV screen. When and if fiber-optic cables reach you—from a cable company or from your local telephone company—multichannel, interactive video will become practical from the technical point of view.

However, fiber-optic cables won't be in place for years because of the high cost and the delays inherent in obtaining approval from public utility commissions. "I would say that it will take five years or so before we start seeing wide-scale deployment of fiber-optic cabling," says Patty Anderson, McGraw-Hill/Datapro's assistant editor/analyst for Voice Networking Systems in Delran, New Jersey. "It'll be another five or six years after that before we'll see a majority of homes and offices wired for fiber optics," Anderson adds.

Sending Your Signals Back
You send your return signal to the ITV control center by modem or low-power transmitter. Your return signal contains minimal data, usually less than 10 bytes for coding your response and another 10 bytes for an identification code. A hand-held controller serves as your interface with the black box.

Modem links are easy to establish, since every customer has a telephone line. You can have problems, however, if another family member is using the telephone. Low-power transmitters avoid this problem. ITV operators using the 218- to 219-MHz bandwidth expect to set up multiple transmitter/receiver sites in the manner of cellular telephone systems. Thus, the transmitter inside the black box

<table>
<thead>
<tr>
<th>ITV Pros</th>
</tr>
</thead>
<tbody>
<tr>
<td>familiar TV access</td>
</tr>
<tr>
<td>low-cost news and product information</td>
</tr>
<tr>
<td>interaction with favorite TV broadcasts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITV Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>child of failed industries</td>
</tr>
<tr>
<td>speed hampered by present technologies</td>
</tr>
<tr>
<td>limited third-party development options</td>
</tr>
</tbody>
</table>

...
Representative ITV Services

Not all the following companies fit the definition of an ITV service precisely, but they are representative of the services available today or planned for the near future.

• **XPress Information Services** (Denver, CO) has been in operation since 1985 and has 25,000 subscribers. Its outbound signal is 9600 bps, distributed on an FM radio subcarrier, normally through cable TV systems. Its black box converts the XPress feed into a serial-port stream that’s fed into your computer. Software on your computer monitors and picks out items of interest to you. XPress is not interactive; there is no return channel.

• **Videoway**, operated by Le Groupe Videotron (Montreal, Quebec, Canada) since 1990, claims 180,000 customers in Canada and 37,000 more in the U.K. It is based on teletext technology, with no interactivity. Besides text, Videoway can distribute personal computer software (currently all games) through a serial port. To overcome the black box’s storage limitations, Videoway sends its data-stream and software inventory over and over again. All computer software offerings are repeated every 15 seconds. Popular text pages repeat more frequently. Because such repetitive transmission requires high bandwidth, Videoway assigns two cable TV channels to support a 4-Mbps data transfer rate.

Le Groupe Videotron is planning to introduce a modern return channel that will add interactivity. The company is also planning a new remote control with a miniature keyboard to support short E-mail messages.

• **Interactive Network** (Mountain View, CA) is a start-up operation based in Sacramento and northern California. It produces its own programming, including games and activities that are tied in to TV programming. TV tie-ins are undertaken without the support of the TV program producers.

Interactive Network’s outbound signal is broadcast on an FM radio subcarrier at 9600 bps. The return path is sent through a 1200-bps modem. Interactive Network also plans to use the 218- to 219-MHz ITV frequency bandwidth.

Unlike with other ITV systems, the Interactive Network display does not appear on your TV screen. Instead, its hand-held control unit has a built-in 8-row by 40-column LCD (240 by 64 pixels). In addition, the control unit contains a miniature keyboard (see the photo).

• **TV Answer** (Reston, VA) successfully petitioned the FCC to assign the 218- to 219-MHz bandwidth to ITV services. A license assignment is under way in major cities, and TV Answer plans to begin operations this summer.

TV Answer’s outbound signal (about 12 Kbps) will be broadcast in a manner resembling that of a cellular telephone. A series of cell sites will broadcast throughout a city, and each cell site will serve up to 64,000 customers. If the number of customers increases, more cells can be set up. The return path will be in the same frequency bandwidth, running at 5000 bps.

TV Answer will be pure interactive; information will be sent only in response to a request. Hewlett-Packard will be the exclusive maker of the 8088-based black box, which will have a serial port and an optional infrared interface that will exchange information with an HP 9SLX palmtop computer, small printers, and other accessories.

• **Television Computer** (Pittsburgh, PA) is the brainchild of a number of Carnegie Mellon University researchers. Still in its planning phase, Television Computer will distribute a 5-Mbps signal through cable TV. Mostly, the service would be one-way, with a modern return channel. The concept is to make its service open for anyone to supply information and develop applications that monitor the data stream, extracting information when appropriate. Plans call for the black box to be fairly powerful, with several megabytes of RAM and a multitasking operating system.

• **The Tandy VIS** system from Tandy (Fort Worth, TX) is a CD-ROM player for your TV, using a modified version of Microsoft Windows. As such, the Tandy VIS is not interactive in the style of other systems described here, but it contains internal expansion slots that will support interactive operation in the future. Its main competitors, the Philips CD-I and the Commodore CDTV/Amiga systems, do not have a path for such interactivity in their current forms.
would need only a few watts of power.

With either method, it takes 5 to 10 seconds to establish a connection and get a screen response. Often, the software inside your black box can supply the necessary interaction, speeding its response time.

In principle, two-way cable systems can support higher-bandwidth return channels and faster response times. But two-way cable is used mainly to support relatively simple features, such as pay-per-view. As with a radio return path, a cable return path eliminates any problems that you might have with someone else using your telephone line.

Information Publishing and Fees
All ITV systems have a gateway at the control center that formats information for distribution. The system operator acts as publisher and decides what information is sent to you. The information can be sent to all customers, to some customers, or just to you.

An ITV operator transmitting at 9600 bps sends out some 90 MB of data each day. This is equivalent to 90 big city newspapers arriving on your doorstep. You can program your black box to continually scan this data and pick out only what interests you. Some ITV systems let you program your black box to switch on your VCR and record this specialized data.

Pure interactive systems only send information on demand. If you do not request information or an interactive feature, nothing is sent, aside from occasional software updates for the black box or program guides.

Other systems mix interactivity with data broadcasting. In this scheme, when the bandwidth isn't needed for interactive information, the system transmits an endless stream of data, such as a delayed stock market ticker, news wires, text from magazines, and so on.

Having both pure interactive systems and broadcast models leads to two different ways to charge for services. Pure interactive systems keep track of every request you make and then charge for each transaction. You, an information provider, or an advertiser might pay that fee, and there may not be a subscription fee. Broadcast ITV systems generally have subscription fees, typically ranging from $15 to $20 per month. A broadcast system can also charge for interactive activity. Almost all systems levy a service fee when you purchase something, and interactive games may have special fees tacked on to the regular charges. For example, Interactive Network (Mountain View, CA) charges $15 per month for basic services and $20 per month for special activities. Besides transaction or subscription fees, most operators charge $200 to $700 for the black box.

Services Are Familiar
Today's ITV operators offer services such as news, weather forecasts, and community BBSes, all of which are familiar to users of services like BIX and Prodigy. Electronic messaging and banking are possible, but at present they are a low priority for most ITV operators.

Many ITV operators offer locally originated and distributed information as well as a nationwide signal. For example, an office-supply shop may want to sell only in its delivery area. Such localized content is possible if the system knows the location of each customer. All systems can localize to some extent, and some can position users down to a city block.

Most ITV systems are not open to customer-supplied
DOS is still the preferred operating system on over 80% of the PCs in Fortune 1,000 companies, according to recent studies.

**Bring Windowing Advantages to DOS.**

Many Fortune 1,000 companies are using DESQview™ as the best solution for keeping the dependability and familiarity of DOS programs and adding multitasking, windowing productivity. DESQview users give up nothing—since it actually runs MS Windows better should users wish to run Windows programs.

As you may know, DESQview 386 has been around for years, evolving into a highly efficient multitasking, windowing environment that extends the power of DOS, giving you increased productivity while conserving precious memory and disk space. In fact, the vast majority of 386 and 486 PCs need no additional memory or disk space to run DESQview.

DESQview 386 gives you pre-emptive multitasking like OS/2, but with 1/6th of the disk space and 1/4th of the memory requirements. It gives you windowing like MS Windows, but with greater speed and efficiency and fewer ‘crashes.’ And DESQview lets you use a mouse or stick to the keyboard.

**You Create the Standards; We Follow.**

We've never been confused about our role. We believe software companies exist to make your job easier and your working day more productive. When publishers step out of that mold and begin to tell you what hardware you need and that you should throw out somebody else’s perfectly good software—well, they simply are not operating in your best interest. Software publishers don’t create standards. You do. And whatever standard you choose, we support it.

If you like a program that only runs in MS Windows, like Wordperfect for Windows, DESQview 386 supports your choice. If you prefer a spreadsheet that runs in DOS, Lotus 1-2-3 Release 3 for example, we support that too. In fact, DESQview 386 lets you run your favorite DOS and Windows programs side-by-side.

**Have Your Cake and Eat It, Too.**

DESQview 386 comes with QEMM-386, the number one memory management utility, and Quarterdeck Manifest, the award-winning memory analysis and monitoring program. Between them, they assure you every last ‘K’ of memory is put to use. In many cases, QEMM can mean the difference between running the TSRs you want and not having enough memory.

And DESQview is an open doorway to the future, too. Our next step up DESQview/X, opens your PC to a network full of possibilities, including graphic workstation standards—X Window System software—all while retaining the compatibility of DESQview.

If you’re as committed to DOS as we are, and feeling left out by the so-called industry leaders, take heart. There’s no reason to leave DOS. If more productivity is what you need, we can provide it. Quarterdeck helps you get the most out of the hardware and software you own today.
Datapro Assist on Demand is the new consulting service from Datapro that can provide you with the answers you need to make fast, accurate decisions. Datapro Assist on Demand delivers authoritative and comprehensive information on computer and communications technology. You pay for only the information you need. No exorbitant consulting fees. No ongoing commitments.

Datapro Assist on Demand puts you in touch with a Datapro analyst. With one quick phone call, you'll soon have all the information and analysis you require, without the effort and bother involved in researching the problem yourself or contracting with an expensive consulting firm.

You can trust Datapro Assist on Demand to provide you with objective facts and analysis custom-tailored to your specific requirements.

To learn more about Datapro Assist on Demand, call us today at 800-328-2776, ext. 2777, or send us a fax at 609-764-2812.

DATAPRO
600 Delran Parkway, Delran, NJ 08075
Discover the best systems in the industrialized world.

The industrial sector is no place for weak technology. And one industrial line has more depth and experience than any other. To get free, detailed product analyses just return this card, fax it to 1-713-933-1029, or call 1-800-627-8700.

I PURCHASE COMPUTERS FOR:

- [ ] Internal company use
- [ ] Resale
- [ ] Both

SOLUTIONS I PROVIDE: __________________________________________

APPLICATIONS I AM RUNNING: _________________________________

PROCESSOR: [ ] 386  [ ] 486  [ ] Other_____________________

CONFIGURATION: [ ] Rackmount  [ ] Bench/desktop
- [ ] Tower  [ ] Industrial workstation  [ ] Cards

ENVIRONMENTAL SPECS: [ ] Heat  [ ] Dust  [ ] Shock
- [ ] Vibration  [ ] Fault tolerant  [ ] Other_____________________

TENTATIVE PURCHASE TIME FRAME: [ ] One month
- [ ] Three months  [ ] Six months  [ ] Over six months

NAME _____________________________________________________

TITLE _____________________________________________________

COMPANY _________________________________________________

PHONE ___________________________________________________

ADDRESS __________________________________________________

CITY _______________________________________________________

STATE ___________________________ ZIP __________

† European inquiries call 31 36 536 5595. Other international inquiries call 1-713-933-8050.
messages for either computer conferencing or E-mail. One reason for this is that your hand-held controller generally lacks a keyboard, so you have to “type” by selecting letters on your screen with a joystick or arrow keys. Also, such relatively complex actions clash with the philosophy underlying ITV. The main services should be easy and entertaining, just like TV.

**Black-Box Programming**

Can independent software developers write programs for the black box? It’s too soon to tell. Today’s ITV systems are closed; the system operator controls the software. Every operator encrypts signals and uses passwords. While some ITV operators have indicated that they may distribute independently developed software, how this would be arranged isn’t clear yet.

Also, most black boxes accept only software that the ITV operator distributes. They lack disk drives, cartridge slots, or other access to the processor. Consequently, independents cannot make their own black box without approval from an ITV operator. Some of the approved black-box manufacturers include heavyweights such as HP and Zenith Electronics.

**Will ITV Survive?**

The history of interactive services is marked by failure. In the 1970s, Warner-Amex Cable’s Qube interactive cable service flopped. In the 1980s, teletext and videotext services were introduced. Teletext offered news and other information through a VBI signal on broadcast TV. Videotext offered interactive data through a telephone line, complete with graphics and color. Several multimillion-dollar efforts failed (e.g., Knight-Ridder’s Viewtron videotext experiment in Florida). A handful of teletext-style services are still available on some cable systems, and the Canadian Videoway service is modeled after teletext technology (see the text box “Representative ITV Services” on page 141). Prodigy keeps the videotext concept alive.

In spite of this checkered past, ITV proponents insist that their time has come. Things are different today, says Richard Cassam, head of new market development for Tandem Computers (Cupertino, CA), a member of the First Cities, which is a 13-company project aimed at eliminating the technical barriers to the delivery of interactive multimedia products. Cassam cites a shift in technology and market acceptance. “More and more things in your daily life mix media,” he says. Cassam gives as examples Apple’s QuickTime movie standard, picture-in-picture TVS, videophones, and smartphones.

Yet when you consider the history of related services and the technical developments required to bring ITV into the mass market, it’s easy to predict that ITV will go bust. “At the very best, there will be a two- or three-year shake-out, lasting through 1996,” says Gary Arlen, president of Arlen Communications (Bethesda, MD), a research company specializing in interactive media.

Arlen predicts that major entertainment and information providers, such as computer game companies (e.g., Sierra On-Line) and publishers (e.g., McGraw-Hill), will stay on the sidelines until after the shake-out. “Then you get into a period of serious competitive marketing,” Arlen says.

Others just don’t know. “It’s either going to be boom or bust,” says Laurie Frick, HP’s product manager for TV Answer’s hardware. “In five years, we will be in over 5 million households—or way under.”

Cary Lu has worked for Children’s Television Workshop and the Nova series of science documentaries and as an animation producer. He is author of The Apple Macintosh Book (Microsoft Press, 1992). You can reach him on BIX c/o “editors.”
STATE OF THE ART

WIRELESS MOBILE COMMUNICATIONS

The infrastructure for ubiquitous wireless data communications is rapidly expanding

JOHN P. MELLO JR. AND PETER WAYNER

In the early days of personal computing, data communications via modems was a black art that was best left to experts. But as the demand for services such as E-mail, file transfer, database access, and remote log-in grew, so did the size, number, and types of data communications services. Accessing them became easier, too. Not surprisingly, the same proliferation of services is taking place in the world of wireless data communications.

Wireless data communications is still principally the domain of large companies with specialized needs, such as a delivery service that must keep track of trucks and packages or a large sales organization that needs to stay in touch with a mobile sales force. This situation is about to change: Within three years, wireless data communications will be as commonplace as wired data communications is today.

Why Wireless?

Two forces are at work to make wireless data communications one of the most important technologies of the next decade. The first is the trend to untether computers from the desktop. With every improvement in integration, miniaturization, and battery technology, the difference between the performance of desktop computers and portables shrinks, as does the premium you pay for portability.

The second force driving wireless data communications is the desire for universal connectivity. Computers and their users are more productive when they have access to external data. The explosive growth in LAN installations over the past five years is ample evidence of the importance placed on connectivity by the business world. Normally, the forces of portability and connectivity are at odds, but wireless data communications lets you have the best of both worlds—freedom from the desktop and connectivity.

Wireless Highways

Despite the narrow focus of current wireless applications, a wide range of wireless transmission media are available. With wireless networks expanding to target general computer users with services such as E-mail, access to standard information services, and support for remote sessions on host computers, you can expect the range of options to grow even more.

The market is made up primarily of RF packet-switched services and cellular phone companies, but this will change as the FCC recognizes the needs of mobile computer users and allocates larger sections of the radio spectrum to what it calls PCSes, or personal communication services (see the text box “PCS and You” on page 148).

Although wireless data communications offers the advantage of not being wirebound, it has its disadvantages as well. First, the radio spectrum is often noisy and prone to losing bits. Losing a few bits for each hundred or thousand that are transferred is not noticeable during a telephone conversation or while listening to a radio program, but it’s disastrous during data transfers. Second, the cost of wireless data communications is higher than that of wired communications in the initial outlay for equipment and in the cost of using the services.

For example, with a cellular modem, you have to pay for the cellular service that connects you to the phone system and reckon with the standard telecommunications charges from, say, BT Tymnet or MCI Mail (see figure 1).

Advanced digital technology, error-correcting codes, and compression algorithms are beginning to provide robust
Although the cellular communications' infrastructure offers advantages, new wireless communications companies and services are springing up. Recently, the FCC proposed allocating three new 30-MHz blocks of the radio spectrum for organizations developing PCSes (personal communication services) that can include both data and voice transmissions. The FCC has placed no restrictions on the use of this part of the spectrum, and it's actively encouraging companies to come up with new and better services.

American Personal Communications (Washington, DC), Cox Enterprises (Atlanta, GA), and Omnipoint Communications (Colorado Springs, CO) have been tentatively granted pioneer status for their work in PCSes, which could eventually help them get a license for part of the spectrum. APC intends to offer digital voice and digital data transmissions over this part of the spectrum. And Cox has plans to provide links with cable TV so that people can offer feedback on TV programs.

The PCS area of the spectrum is undeveloped, and it will be some time before companies begin to market services that use these bands. This area, however, offers the greatest hope for innovative, interactive networks. Only time will tell whether those in the industry have the imagination and the capital to find markets for their PCSes.

WIRELESS COMMUNICATIONS

PCS and You

The premium you pay to transmit 500 KB of data using wireless communications differs depending on the medium you use. The packet-switched radio data is for the RAM Mobile Data network, and the satellite data is for Iridium. The cellular data assumes 2400-bps throughput and a $50-per-month access fee. Capital costs, which are not included in the figure, run about $1500 for packet-switched radio communications, $1000 for cellular communications, and $10,000 for satellite service.
WIRELESS COMMUNICATIONS

The Ardis network also enables Avis to process a customer’s car request in the time it takes the customer to take the Avis bus from the airport to the company’s car lot. According to Robert B. Euler, vice president of marketing for Ardis, a unique feature of the network is its reliable in-building communications capability, which is important in metropolitan areas.

Packet-switched radio communications are expensive. For instance, a basic subscription to the RAM Mobile Data network costs $89 per month, which includes 100 50-word units. Additional 50-word units cost 29 cents each. This is on top of any fees charged by E-mail or gateway providers, such as AT&T Mail, which will provide a connection to the RAM Mobile Data network this year.

Another drawback to packet-switched radio communications is the incompatibility of modems used by the different services: The Ericsson GE Mobidem works only with the RAM Mobile Data network, and the Motorola RPM 840 is compatible only with the Ardis network. However, the Motorola Infotac modem, which works with off-the-shelf software, will be compatible with both systems.

In the Wings

Last summer, the FCC gave the nod to Mobile Telecommunication Technologies (Jackson, MS) to build the third nationwide wireless data network. The proposed network would run in a 50-kHz block of the 931-MHz band and simulcast data at 24,000 bps (Ardis is just now implementing speeds of 19,700 bps on its system).

According to Mtel, its network will achieve the high data transfer rates by enhancing a technology called MCM (multicarrier modulation). In conventional paging, a baud is equal to a bit, but with MCM, a baud is 8 bits. Thus, Mtel can get higher data throughput for a given data transfer rate.

That’s important because of the trade-off between simulcast’s superior area coverage and its slow data transfer rates. MCM provides for high-speed simulcasting. Donald Warfield, vice president for strategic marketing for SkyTel, which is also owned by Mtel, says that simulcast is more reliable for building penetration and provides seamless coverage throughout an area.

Mtel’s plans for its nationwide wireless network are ambitious. Among the services it expects to provide are acknowledgment paging with prestored messages using conventional pagers, two-way data messaging using palm-size computers or PCMCIA cards, fixed-location data distribution (e.g., point-of-sale terminals), roaming data collection, information services, E-mail services, industrial remote control (e.g., monitoring alarms and reporting stolen vehicles), and integration with mobile satellite services to provide seamless network coverage. Mtel expects the network to be operational 12 to 18 months from the time the company receives approval from the FCC, which could come this year.

Cellular Connections

Although they rely on a less-robust analog technology, the cellular phone companies have a number of structural advantages over the data-only networks (e.g., RAM Mobile Data and Ardis) — the most important being the installed base of cellular transmitters. Nearly all U.S. cities have two or more competing cellular phone systems. And most important, cellular phone hardware is relatively inexpensive: about $100 per phone in wholesale amounts. These phones need just a modem and an adapter to start transmitting data. You can buy a mobile phone/modem combination for the average laptop for less than you would pay for a Mobidem.

Many companies produce cellular modems and adapters that can be plugged into cellular phones. For example, Microcom (Norwood, MA) recently began shipping the MicroPorte 4232bis with fax modem. This portable modem comes with MNP 10, a protocol designed to work in the sketchy world of cellular communications. ZyXel USA (Anaheim, CA) is another company that is making a push in the cellular modem market. Like Microcom, it has included a number of features with its modems to improve the reliability of cellular data transmission.

The MicroPorte and other cellular modems don’t require special equipment from the cellular communications provider, although the MicroPorte must be connected to another MNP 10–capable modem to use MNP 10. In addition, regular modems require an adapter to simulate central-switching functions that a modem expects (e.g., a dial tone).

Special protocols like MNP 10 are needed because, unlike their wirebound kin, cellular modems must deal with an adverse environment. For instance, when you place a cellular call, a signal is sent to a transmission tower. Each tower covers a cell about 8 miles in diameter. When you travel from one cell to another, your signal must be handed off to the next cell. When this happens, there’s a break in the signal, lasting from a few hundred milliseconds to over a second. It’s enough to give conventional modems fits, because they depend on continuous signals. Cellular modems, on the other hand, are designed to operate in this flaky environment. They perform error correction and data compression, increase or decrease transmission speed, change packet sizes, and counteract fluctuating signals.

Cellular modems are also expensive, due primarily to the robust error checking they require and the fact that the market for them is smaller than the market for conventional modems. Cellular modems can cost as much as $1500, and then there’s the cost of the phone calls. With a subscription to a cellular carrier costing $40 a month and calls costing 60 cents a minute during prime time, you can run up a hefty phone bill in no time.

Packet-Switched Cellular

Because data transmission over cellular voice lines consumes a lot of the voice bandwidth in a cell, cellular companies are constantly investigating other methods of sending digital information over cellular lines. One strategy using analog cellular transmission for data communications is CDPD (cellular digital packet...
Broadcasting Without a License

Most wireless services require that you subscribe to a central service run by a licensed company. These companies manage their radio spectrum and charge for every byte going through their gateways.

The FCC is marking off a portion of the spectrum for unlicensed, low-power use for mobile computers. These bands will let you set up wireless networks within a building so that laptops and other computers can be moved from desk to conference room and still maintain links with the network.

The FCC proposes to set aside 20 MHz of bandwidth (1 × 10-MHz channel, 4 × 1.25-MHz channels, and 50 × 100-KHz channels) for unlicensed service in response to a request from Apple Computer. The power limitations should prevent a signal from propagating beyond the floor of a standard office building.

Naturally, these systems could lead to chaos if everyone started transmitting in such a narrow part of the spectrum. In fact, carriers like the RAM Mobile Data network and the cellular telephone companies are counting on this chaos to drive customers to their proprietary networks, where they provide management. The unlicensed bands, however, don’t need to be Babel-like. It’s possible to create standards for these bands that will be strong enough to maintain order within the band.

The WINForum (Wireless Information Networks Forum) is an industry group based in Arlington, Virginia, that designs protocols for unlicensed networks. It’s determining what power levels should be used by the devices and how long the devices should be listening for free air time before broadcasting.

The final WINForum model may be similar to the Ethernet standard, which requires each computer to “listen” for a random amount of time before sending a packet. The group was to release a suggested etiquette for using the spectrum by the end of 1992, and devices using this part of the spectrum could arrive by 1994. The FCC must approve the plan before manufacturers can ship these products.

Most manufacturers and the WINForum believe that the 20-MHz block of the spectrum (1910 to 1930 MHz) proposed to be allocated to unlicensed systems is hopelessly inadequate for the demand. They expect such devices to find widespread acceptance. When that happens, they hope the FCC will realize that this technology is the best way to provide short-range wireless service to the country. Benn Kobb, president of the WINForum, says, “The radio spectrum is public property. Citizens, schools, and businesses need to have access to it.”

data), a technology for transmitting data over unused cellular channels based on IBM’s CellPlan II technology.

CDPD offers high bandwidth (about 19Kbps with compression) and continuous connections to networks like the IBM data network. IBM, for instance, will offer 3270 emulation over the airwaves. And CDPD systems can offer more than the store-and-forward E-mail systems, because the high bandwidth makes it easy to run a remote session from a ski lift or a dive shack.

In conjunction with IBM, nine of the country’s 10 largest cellular companies are testing CDPD in the San Francisco Bay area. The availability of CDPD in the future will depend on whether your local cellular telephone company decides to install the necessary hardware. The cost for a mobile phone/modem combination for a laptop will be from $200 to $400, with the cost of monthly service varying from carrier to carrier. Rob Mechaley, vice president of technology for McCaw Cellular (Seattle, WA), says that his company is looking at options that will provide basic CDPD service for $35 to $50 a month.

CDPD uses a full voice channel—all 30 KHz. CDPD hops from channel to channel to avoid interference with voice transmission. Even in heavy traffic, there’s excess capacity that can be used for data. For example, a guard-time interval between voice assignments can last as long as 10 seconds. “You can transmit a tremendous amount of data in 10 seconds,” says Joe Grlica, director of business development at Bell Atlantic Mobile Systems (Philadelphia, PA).

According to Brandon Nixon, product-line manager for CDPD at Pacific Communications Sciences (San Diego, CA), a final specification for the technology was expected to be published by the end of 1992, and hardware for it should start appearing by mid-1993. But skeptics say that time frame is too optimistic.

“They’ve got a lot of work to do,” says James Hobbs, vice president of BellSouth Mobile Systems (Atlanta, GA), which has a stake in RAM Mobile Data. “I do not think it will be deployed for another four years.” Hobbs believes that CDPD was announced early to preempt the development and implementation of competing technologies.

Living in the Shadows
Cellular Data, Inc., (Palo Alto, CA) offers a system that provides data communications over cellular telephone systems. In the cellular system, voice frequencies are separated by 3-KHz frequencies called guardbands, which prevent voice calls from interfering with each other. CDI’s system uses the guardbands for data communications.

The company acknowledges that its system will not have the same capacity or bandwidth as the CDPD approach, but because it requires less power, the transceivers can be smaller and have less battery power. CDI hopes to attract customers who need services such as electronic messaging but don’t need to run remote sessions with host computers over the air. Because the parts of the radio spectrum
Now There's A Whole New Way To Get Energy Out Of Thin Air.
The 20 Hour Laptop Battery From AER Energy.

This may come as a bit of a shock, but our new rechargeable zinc-air computer battery runs on air. Introducing the AER Energy™ Power 20™ Rechargeable Battery System. Through patented design, AER Energy's stand-alone battery system uses oxygen from the atmosphere to generate electricity. Enough electricity to give a portable computer 20* hours of run time between charges.

Three Times The Energy Of NiCd.
This amazing ability to run on air also gives the Power 20 battery an extremely high energy density, which means more energy per pound. In fact, tests prove it produces an incredible three times the energy by weight of conventional nickel-cadmium batteries. All of which explains how our Power 20 12-volt accessory battery can increase a laptop's run time to an unprecedented 20 hours on a single charge.

More Portable Computing. Our dramatic improvement in energy per pound also improves portability. You can forget about the hassles of carrying a charger and multiple battery packs, the memory effect of NiCds, or worrying about where and when to recharge. Plus, our battery system allows you to simultaneously power your computer and handheld cellular phone. So see why there's so much electricity in the air. For more information call 1-800-Power 20 (1-800-769-3720).

*20 hours of run time is the average for all computers tested. Actual results will depend upon the computer being powered and the application in use. ©1993 AER Energy Resources, Inc. AER Energy™ and Power 20™ are trademarks of AER Energy Resources, Inc.

Circle 164 on Inquiry Card.
One-Way Transmissions

T he original mobile data communication system was the pager, which lets you receive data transmitted from a central antenna over a wide area. Pager technology has improved dramatically, and the best modern pagers can receive and display a stream of alphanumeric characters.

SkyTel (Washington, DC) is the nation’s largest paging and messaging service, with 188,500 subscribers. One advantage SkyTel has over most two-way systems is its range of coverage. Using the Westar IV communications satellite, messages are beamed to hundreds of ground stations simultaneously.

“SkyTel blankets North America,” a company representative explained, “so I could reach you with your pager or palmtop far more easily than I could track you down with a cellular phone.”

SkyTel also has links to the major E-mail systems. When you receive an E-mail message, you receive either an alert or the first 240 characters of the message. You can access the full message from a wired system.

Boynton Beach, Florida–based EMBARC/Motorola’s EMBARC (Electronic Mail Broadcast to a Roaming Computer) system is smaller than SkyTel, although it was scheduled to be in 220 cities and reach 90 percent of the U.S. industrial population by the end of 1992 (see figure A). Its messages, however, are bigger (up to 1500 characters) than SkyTel’s. In addition, the EMBARC system transmits 8-bit data, so binary files can be moved on the system.

SkyTel transmits only 7-bit data. EMBARC/Motorola implemented a messaging switch based on the X.400 standard, which opens its system to a wide range of E-mail systems. You can tag a message you have received and write a response. The next time you’re connected to a modem, select the EMBARC option in your E-mail package, and the EMBARC system automatically logs you onto the switch and sends your response to the sender via the X.400 gateway.

Brad Davis, director of strategic marketing at EMBARC/Motorola, says his company’s system offers another advantage. “A broadcast fax has an incremental cost per recipient,” he says. “With EMBARC, you can send a message to 1000 people at the same price it costs to send it to just one.”

The EMBARC system uses Motorola’s NewsStream receivers, which cost $395. Motorola has announced a PCMCIA-2 version of the NewsStream that will have a larger internal memory (128 KB) and fit inside laptops. According to the announcement, this unit should ship in the second quarter of 1993 and sell for under $400.

EMBARC/Motorola charges a subscription fee of $15 a month, which includes an on-line version of USA Today. The price of messages is based on their size and the priority assigned to them. To send a 100-character message with overnight priority costs 5 cents; to send a message of the same length with immediate priority costs 50 cents.

Recently, EMBARC/Motorola and Individual (Cambridge, MA) created a service called Heads Up. Subscribers to the service receive abstracts of articles from 96 categories. A subscriber can obtain the full text of an article by dialing an 800 number and identifying the piece with a serial number. The service simply loads the text into the subscriber’s electronic mailbox. Heads Up costs $30 a month for four categories and $15 for each additional four categories. Full-text versions of stories cost $3.95 each.

Ex Machina (New York, NY) devotes itself to providing services that enable you to connect your computer to a paging system. The system works with a Motorola pager/receiver that can store up to 2000 alphanumeric characters and forward the data through a serial port. This capability allows you to update laptop computers or personal assistants remotely. For example, a secretary in a main office can cancel or add appointments to a calendar and transmit the changes to a salesperson’s portable calendar.

Ex Machina offers developer’s kits that enable DOS, Windows, and Mac developers to incorporate wireless data transfer into their applications. The company plans to incorporate other platforms in the future. Ex Machina is also offering software called Notify, which will serve as a gateway between the popular QuickMail program running on the Mac and roaming pagers.

Another company set to offer one-

used in the CDI approach are different than those used by the CDPD system, some cellular carriers may install both systems and let their customers choose. CDI is currently running a test system in Pueblo, Colorado.

Bell Atlantic expects to start selling the CDI system commercially in the first quarter of the year in 25 to 30 cells in the Baltimore area. Among the applications Bell Atlantic sees for the technology are point-of-sale verification, telemetry, vending-machine management, and alarm systems.

According to Mike Franklin, director of product management for wireless data at Bell Atlantic, the CDI system can make alarm systems more secure, because there are no wires to cut. Alarm services in areas not easily accessible to wired networks (e.g., the monitoring of construction sites) are also ideal for the system. “It’s totally portable. It can be here one day and there tomorrow, without having the alarm circuit reinstalled,” Franklin says.

Pros and Cons
With billions of dollars at stake, a war of words has broken out between cellular companies and RF service providers. Says Bell Atlantic’s Grlica, “We can utilize our infrastructure to keep the cost of our data network much lower than that of others who have to build from scratch.”

Lee Horsman, marketing manager for CDI, also cites the advantages of the cellular infrastructure, with its technical personnel and 8000 sites. Each site can send packet-switched data cost-effectively anywhere in the world, because they are all connected to the public switch network, he says.

But the breadth of the existing cellular system also has disadvantages, according to Ardis’s Euler. If the cellular companies
Figure A: You send an EMBARC message from your computer or workstation (a) using X.400 to the central EMBARC switch (b), where a satellite uplink (c) transmits it to a satellite (d). The satellite sends the message to downlink stations (e), which relay them to NewsStream receivers (f).

The two-way systems described thus far are earthbound: They rely on ground antennas to transmit data to roaming computers. This approach works well in New York City, where the population density can support a large packet-switched data transmission system or cellular infrastructure, but it just will not work in Alaska, where cells can be few and far between. Fortunately, satellites are able to fill in the holes.

The Omnitrac system, which is produced by Qualcomm (San Diego, CA), lets you receive messages anywhere in the U.S.
Inmarsat provides coverage to most of the earth’s surface.

Figure 2: Using four geosynchronous satellites, Inmarsat provides coverage to most of the earth's surface.

Omnitracs is marketed to trucking companies, but some individuals use it, too. Steve Roberts, a spokesman for Qualcomm, drives around the country on a pedal-powered bicycle equipped with the system. The flexibility and mobility of the system, however, require large antennas (the antennas are about the size of a basketball, and they come in weatherproof housing for mounting outside of a truck) and power supplies that can't be carried around and run off AA battery power.

Mobile Telesystems (Gaithersburg, MD) offers Inmarsat, a competing system that covers every location on earth except the North and South Poles (see figure 2). During the Gulf War, CNN correspondent Peter Arnett used the Inmarsat system to send his reporting out of Baghdad when the allied air attack began. He scooped the other networks because, unlike the telephone lines that were cut soon after the attack began, the satellite system continued to operate.

The Inmarsat system provides two different levels of service. The first level transmits voice communication for about $7 a minute using a base station that retails for $45,000. The second level provides packet-switched data for about 1 cent a byte. This 13-pound system costs $10,000. The central switch provides X.25 gateway access to E-mail on the wire-bound networks.

**The Pace of Change**

The world of wireless data communications is changing at a fantastic pace. Bell Atlantic announced that it will be starting up a trial version of the CDI system in early 1993. In addition to Bell Atlantic’s CDI program, the CDPD system is already being tested in Silicon Valley, and the cellular industry hopes to start installing the system elsewhere by the middle of 1993. And the RAM Mobile Data network will have two new base stations installed per week over the next several months, bringing coverage to over 90 percent of the U.S. population.

The market research firm Forrester Research (Cambridge, MA) expects the number of subscribers to wireless networks to reach 2.5 million by 1997. And according to Motorola, the market for wireless E-mail will reach $1 billion by 1996 because of advances in business decentralization and portable computing.

The competition over the next several years will be brutal because the standards will be decided, in a large part, by the companies that ship the most boxes. Most of the technical problems involved with wireless data communications are solved, but the marketing is just beginning. Once the infrastructure is mature, wireless mobile computing will be as painless as dialing a telephone.

John P. Mello Jr. is a freelance technology writer based in Woonsocket, Rhode Island. You can reach him on BIX c/o editors or at MCI Mail at 264-1102. Peter Wayner is a BYTE consulting editor based in Baltimore, Maryland. You can reach him on BIX as "pwayner."
How much longer can you afford to wait?

Create Overlaid Programs-Fast.
BLINKER™, the world's first and fastest dynamic overlay linker, reduces your link time to seconds and reduces program memory requirements. Now you can use one linker for all your software projects.

Memory Swap Function.
BLINKER is the ONLY linker to offer an integrated memory swap function, so you can run other large programs from within your program, with negligible memory overhead.

Time is Money.
BLINKER offers all this in a fraction of the time it takes to link with your current overlay linker. You know time is money, and link time is no exception.

Free Demo
To try our free demo on your own code

Call: 804-747-6700 or FAX: 804-747-4200

Order now!
If you can't wait any longer, we offer a risk free 30 day money back guarantee. Available in 5.25" or 3.5" diskette format.

Price $299
plus shipping & handling

© 1991 Blinkinc. Blinker is a trademark of ASM, Inc. Offer only applicable in US and Canada.

Circle 152 on Inquiry Card (RESELLERS: 153).
Credit Card ADAPTERS
Insert network here.

As convenient as they are, portables have been out of the network loop long enough.

Now the notebook is the network.

Introducing the IBM family of Credit Card Adapters.

We’re revolutionizing the business by miniaturizing our award-winning adapter card technology and conforming it to PCMCIA standards. So almost any portable can operate as a fully enabled node on virtually any network.

Suddenly, personal computing tools are transformed into corporate weapons that can give your enterprise a competitive edge while enhancing your investment in both the network and your notebooks. Imagine providing high-speed data transfer capabilities so users can run applications, retrieve information, and access corporate data with their notebooks.

These new adapter cards are just part of our growing family of LAN solutions meeting your needs now and into the future.

To find out more, talk to your IBM authorized remarketer, or call 1 800 IBM-CALL, ext. S21. If you’re looking for someone to help you get more out of your network and your portables, we’re ready to fill the slot.

IBM—meeting your LAN adapter technology needs.

- Conforms to PCMCIA Release 2.0 standards.
- 5-year warranty.
- 3 industry standard options: Token-Ring, Ethernet, 3270 Emulation.
Bigger, Brighter, and Flicker-free  
CTX Professional Monitors

Built with ergonomic ingenuity and trend-setting technology, **CTX Professional Monitors** (available in 14", 15" & 17") are perfect for WINDOWS users:

- **Flicker-free** images at VESA
- **Non-interlaced** 72 Hz refresh rate reduce eye strain;
- **High resolutions** up to 1280 x 1024 add to image sharpness and increase the amount of information on WINDOWS;
- **Full Screen Display** is a tremendous advantage in Graphics User Interface and Multimedia applications;

Dynamic screen sizing and positioning are achieved through **Programmable Control** in Professional Series (CPS) or Manual Control in Multiscan Series (CMS);
- **Flat-Square Screen** (15" & 17") increases display clarity while reducing distortion and screen glare.
- **Low Radiation** (MPRII) models are available for an additional protection against electromagnetic radiation.
- To rediscover what is coming through your bright WINDOWS, look into a brilliant **CTX Professional monitor today.**

©Copyright 1992. CTX International, Inc. All Rights Reserved. All brand or product names are trademarks or registered trademarks of their respective owners. 
Circle 78 on Inquiry Card (RESELLERS: 79).
STRETCHING THE ETHER

How wireless technologies make the most of limited bandwidth

PETER WAYNER

Radio transmission is based on the principle that an accelerating electron creates an electromagnetic field. Such a field accelerates other electrons. Thus, it's possible to move electrons in one place and have the resulting electromagnetic field push electrons in another location. The more electrons you move, the stronger the signal and the farther away it can be detected. All this happens at close to the speed of light.

Moving electrons is simple. The trick is to move them in a coordinated fashion. With this capability, you can move information across great distances. And this, in a nutshell, is the basis of wireless data communications.

Radio Waves
The standard approach to radio transmission is to move electrons at a specific frequency and either modulate the strength of the signal (as in AM radio) or make slight changes in the frequency of the signal (as in FM radio). Faster frequencies make it easier to send more information, but faster oscillations require more complicated electronics.

Two signals on the same frequency compete and drown each other out. To avoid this chaos, the FCC allocates parts of the spectrum for specific uses. Early on, TV and radio systems received licenses for their frequencies. The FCC also allocated regions of the spectrum for personal use (e.g., the CB and ham radio bands). But the spectrum is a limited quantity, and the demands of new technologies are putting pressure on the FCC to allocate frequencies to many different groups.

The technical challenge is to pack more users into a narrow band of the spectrum,
If you are an OS/2 or Windows NT developer and you are porting an application that needs robust 32-bit support, your wait is over. Microway is currently shipping NPD Fortran-386/486 for OS/2 or NT, along with our C/C++ and Pascal. Our products work with the IBM and MS linkers and can directly access their respective APIs, taking full advantage of the 386/486 gigabyte address space. The biggest advantage of these new 32-bit operating systems over DOS is their ability to pre-emptively multitask, which dramatically improves the speed of hard disk I/O and multitasking in general.

Microway has also engineered a complete line of 486 workstations which are ideal platforms for both developers and users who are into number crunching. Using removable hard disks, we can set up a system for you that can be used for DOS, NT, OS/2 and UNIX development! Scientists and engineers will appreciate the fact that our top of the line 486 boxes use industrial strength power and cooling — that's one of the reasons why half of our Number Smasher-860s have gone out in a 50 MHz 486 B2 workstation. Another important reason is the fact that the 860 can save you thousands of dollars per month in Cray or 3000 rentals. For more information, please call Microway's Technical Support Department at (508) 746-7341.

### 386, 486 and i860 Compilers

Our NPD family of compilers generate globally optimized, mainframe quality code that runs on the 386, 486, or i860 in protected mode under Coherent, DESQView, UNIX, OS/2, or extended DOS. The compilers address 4 gigabytes of memory while supporting the 287, 387, Weitek, and Cyrix EMM coprocessors. Applications can mix code from all three compilers and assembly language. To simplify your ports, we offer ClearView, our full-featured, windowing symbolic debugger that works with DOS versions of NPD 386 and 486 compilers.

NPD Fortran™ is a full F77 with F66 and DOD extensions that is 99% VMS compatible. Also contains new F90 features & MS compatibility.

NPD C/C++™ runs in three modes: K&R with Sys V and MS C extensions; 100% ANSI C; and C++ Release 2.1 compatible.

NPD Pascal™ is a full ANS/IEEE Pascal, with extensions from C and BSD 4.2 Pascal.

### 386/486 Custom Workstations

A Microway Black Tower is the ideal solution for a cost-effective desktop system, personal supercomputer, file or computation server, or industrial PC. Microway workstations are ideal for computer, file or computation servers, government research labs and university engineering departments on applications ranging from CAD to financial analysis, software development, and more.

Some examples include:

- 386/486-40 ISA 64K cache 200W $1395
- 386/486-33 ISA 64K cache 250W $2495
- 386/486-50 ISA 64K cache 250W $3995
- 386/486-50 ISA 64K cache 350W $4995

Our Tenth Anniversary

Since 1982, Microway has been serving the PC community and we wish to thank all of our customers for their continued support.

### i860 Vectorizers and Libraries

NPD NAG/860 is a Microway port of the NAG workstation library to the i860. ...

Number Smasher-860™

Number Smasher-860 is the highest performance coprocessor card ever to run in an ISA or EISA bus or as part of a transputer system. Delivers up to 80 million floating point operations per second at 40 MHz and produces 11.8 double precision Linpack megaflops.

Number Smasher-860 is standard with an EISA or ISA interface, 8 meg of high speed memory, and your choice of NPD Fortran, C/C++, or Pascal for the 860 running under MS-DOS, UNIX, OS/2, SunOS, or DESQview. ...

Number Smasher-860 runs in three modes: K&R with hardware interface routines.

### Math Coprocessors/Overdrive

WEITEK: 4167-25/33 ...

INTEL: 287XL ...

Cygrix: 83376-25: $79
83376-33: $99
83376-40: $125
STRETCHING THE ETHER

Figure 1: In cellular transmissions, the same frequencies can't be used in adjacent cells. Frequencies must be isolated to avoid interference.

and a good example of this is cellular radio. Before the invention of this technology, radio telephone service was expensive and limited because each call took up an entire frequency. Cellular technology works because the system can limit the power of each signal to the minimum amount necessary. This limits interference to a small area around the base station and the portable phone. When you place many antennas around a city, towers in different locations can use the same frequency without experiencing interference.

Cellular Maps

The standard configuration of a cellular telephone system is a grid of hexagonal cells. Initially, a city may have only one cell. When competition for the limited channels becomes too fierce, the cell can be divided into seven smaller hexagonal cells of one-third the radius of the original cell. The subdivision can be repeated, and some companies talk about nanocellular systems that cover an office building with thousands of cells often no more than 3 or 4 feet in diameter. Adjacent cells must use different frequencies, but cells on opposite sides of the grid can use the same frequency without experiencing interference (see figure 1).

The CDPD (cellular digital packet data) system was designed by IBM and the cellular communications companies to provide data communications in the cellular range without impeding voice systems. The system uses telephone channels just as a modem uses a telephone line, but it's nimble enough to jump frequencies when a new telephone call starts in the cell. The system is limited by the number of frequencies available in the cell. When all the frequencies are in use, the network locks out new connections. This all-or-nothing performance is different from the data-only network from RAM Mobile Data (New York, NY), in which the data rate merely slows as more users enter the system and compete for free slots.

It's expensive to subdivide a cell and add new antennas and telephone lines to handle new calls. Another method of increasing the capacity of a system is to turn to digital technologies that can use sophisticated compression techniques. The best digital systems model the human voice box to provide the optimal compression of conversation. Some of the best vocoders (i.e., the compression chips that convert voice to bits) can encode a 30-kHz signal in about 4000 bps.

Once voice signals are converted to bits, there are a number of ways of packing the signals closer together. A system known as TDMA (time division multiple access) is able to place three signals into a channel by interleaving them. Another approach that is being developed by Qualcomm (San Diego, CA), called CDMA (code division multiple access), uses spread-spectrum spreading codes to fit up to 10 times more data into a channel. One frequency can handle several connections at a time (see figure 2).

The CDMA system also includes an improved method of handing off calls between cells. For example, imagine you are cruising along the highway, talking on a frequency, and your car crosses the boundary of the cell. The central station of the

Cellular Transmission
- well-established infrastructure
- lower hardware costs
- lower transmission costs

Packet-Switched Radio Transmission
- more reliable
- faster
- optimized for data

What business does sound have in a computer?

For starters, you can increase your productivity when you proof spreadsheets with the new Microsoft Windows Sound System. Just highlight a series of numbers or words on the screen and it will read them back to you. It will even read them aloud as you enter them, if you like. To hear more, turn the page.
Essential Development Tools At Your Fingertips.

MKS Toolkit — All the Tools of the Trade for Professional Programmers and Application Developers.

MKS Toolkit puts a powerful suite of easy-to-use development utilities within your grasp. MKS Toolkit was designed by developers for developers. That’s how we knew precisely which programming instruments to give you — and how to make them work together so you can achieve levels of productivity you’ve only dreamed about — until now!

Developers working on DOS can now get the extraordinary power of tools that were once available only on UNIX. Only MKS Toolkit delivers a full suite of these essential tools on your PC, and allows you to switch quickly back to your DOS applications. For multi-platform environments, MKS Toolkit is fully compatible with UNIX systems, and tracks both POSIX and x/Open standards.

Now it’s easy to take hold of all the tools of your trade. MKS Toolkit enables you to develop the technology of tomorrow — today.

Start shaping the applications of the future! Call now to order your copy of MKS Toolkit.

Some of the 170+ utilities in MKS Toolkit 4.1:

- A new, easy-to-use, efficient UUCP communications package that connects you to the world.
- MKS AWK, the fast prototyping and report generating language, now with a new AWK compiler.
- MKS KornShell, the full-featured programming language that allows you to interchange scripts with UNIX and POSIX systems.
- MKS Make, the software construction utility that lets you update files automatically.
- MKS VI, the full-screen editor.
- New Windows icons for frequently used commands.
- Interoperability with Open VMS, CTOS and MPE/iX.
- A full array of commands for profiling, compression, archiving, file processing and customizing your PC environment.

MKS
35 King Street North
Waterloo, Ontario, Canada
N2J 2W9

Price: $299, Upgrade $99. Call for multi-user pricing. 30 day money back guarantee. For information on how to order, call MKS at: 1-800-265-2797 (US and Canada) or (519) 884-2251 • Fax (519) 884-8861. International customers please call:

AUSTRALIA +61 03 580 1333 • BRAZIL +55 83 333 1904 • DENMARK +45 87 72 00 • FRANCE +33 1 48 77 22 44
+33 1 47 81 10 11 • GERMANY +49 0721 988 280 • +49 0521 50762 0 • +49 06126 595 0 / +49 0221 35 15 24
JAPAN +81 3 5702 0331 • NETHERLANDS +31 0800 6 14 24 63 • SWEDEN +46 013 111988
SWITZERLAND +41 061 421 32 01 • UK +44 0364 50499 / +44 0765 244114 / +44 071 833 1022

MKS and MKS Toolkit, MKS KornShell, MKS AWK, MKS Make, MKS UUCP and MKS VI are trademarks of Mortice Kern Systems Inc. UNIX is a registered trademark of UNIX System Laboratories, Inc. All other trademarks are acknowledged.

Circle 104 on Inquiry Card.
STRETCHING THE ETHER

cell notices this when your signal becomes weaker. It notifies the neighboring cell to pick up your call, and your telephone must switch frequencies.

This isn’t much of a problem when you are talking—you might lose a word or two, but humans compensate for this. But data transmissions are less forgiving, and the lost bits can mangle a fax transmission or a database access. CDMA uses a “soft” hand-off system that lets both cells broadcast the same signal at the same time on the same frequency. As the car moves from one cell to another, the strength of the closer signal grows and that of the old one fades. When your car is in the range of the new cell, the old cell’s transmitter stops broadcasting your call.

Data-Only Networks

Pure data networks use different methods than cellular networks. RAM Mobile Data’s Mobitex system breaks data into packets of information and transmits the packets individually. The first packet contains addressing information and the number of subsequent packets. The other packets contain 48-bit blocks of data and 21 bits of error-correcting information. All the bits form an overdetermined system of linear equations that have 48 unknowns and 69 equations.

Basic algebra is used to detect and fix errors. If one bit is flipped by mistake, the equations will not be consistent, making it possible to identify and correct single-bit and bit-pair errors. The protocol is capable of detecting errors in up to 15 consecutive bits, although there isn’t enough information to correct errors this large. In such cases, the receiver can ask that the data be resent.

The RAM Mobile Data Mobitex network requires that every packet be acknowledged. If it’s not, the network rebroadcasts the packet until it is successfully received and acknowledged. This redundancy is important when you drive through a tunnel and break the radio connection. But what if the acknowledgment signal from the portable to the base station is mangled? The base station assumes that the packet did not arrive successfully and rebroadcasts it. Suddenly, your machine is flooded with duplicate packets. This can lead to an endless cycle of acknowledgments.

The Mobitex system avoids this problem by labeling each packet with a number from 1 to 15. The stations discard packets with identical numbers.

The RAM Mobile Data Mobitex network accommodates the thousands of transmitters that want to communicate with the base station with a procedure called slotted aloha. At predetermined intervals, the base station broadcasts a “free” message, which indicates that there will be n slots of free airtime of x milliseconds apiece available. Computers wait for this message and use an internal pseudorandom number generator to choose one of the n slots. The base station puts these contact requests in a queue and deals with them in turn. Collisions between rival computers broadcasting at the same time are minimal as long as enough free messages are broadcast.

The network’s protocol ensures that the

![Figure 2: With CDMA, all users share the same frequency, but each signal is created with a unique code—the spreading code—that replicates the original signal when multiplied by the signal. As long as the receiver uses the same code, only one signal at the receiving end will decode clearly—that is, as something other than noise.](image)

What business does sound have in a computer?

Now you can communicate more effectively by adding your voice, or even music, to documents and presentations. Just record it, drag it and drop it in.

Microsoft Windows Sound System can also recognize and execute spoken commands like open, cut and paste. You can easily create custom commands in any application for the Microsoft Windows operating system. Want to hear something else? Turn the page.
Now the leader in Windows graphics puts its know-how behind the world’s #1 Windows flowcharting solution!

Introducing ABC FlowCharter® 2.0 from Micrografx. With all the terrific features of the original. Plus an array of exciting new features that make it better, faster, easier than ever!

Our all-new user interface conveniently displays tools in a handy toolbox. No more searching through menus. Just point and click!

Customizable shapes and shape palettes let you tailor ABC FlowCharter 2.0 to your particular applications. And we've added new palettes of symbols for specialized charts like dataflow diagrams, audit diagrams, and many, many more.

You'll be able to choose from new line types and styles, including curved lines. And take advantage of an exciting new feature that automatically connects shapes.

Enhanced text capabilities let you edit text right on the chart, and mix different fonts, sizes and styles at will.

And best of all, you'll enjoy our friendly 24-hour telephone support (weekend hours too). (U.S. only)

“A Windows-based package that’s both powerful and easy to use.”

InfoWorld
April 20, 1990

“Turns making flowcharts into child’s play.”

DBMS Magazine
August 1991

CALL TODAY FOR UPGRADE INFORMATION
1-800-998-0153

If you're already an ABC FlowCharter user, call now for upgrade information. And if you're not, find out just how fast and easy flowcharting can be – with all-new ABC FlowCharter 2.0!
STRETCHING THE ETHER

balance between throughput and free slots can be varied during the day. During periods of high loads, a network might broadcast only a small number of packets before sending a free message to look for new contacts. When the load is low, a network can send many more packets to stations before initiating a free message, because it can be reasonably certain that there will not be many new field units requesting contact.

The Internet Model
A company in California called Tetherless Access, Ltd., is designing a system to link all the computers in a metropolis into a wireless network. The big difference between this vision and that of other networks is that here the computers organize themselves; there is no company controlling the system and taking a few pennies for every squirt of data that is sent over the airwaves.

The basic principle of the TAL network is that each computer routes every packet that comes its way that isn’t addressed to it. When a computer wants to send a message, it simply broadcasts the packet with the address, and the other computers in the network repeat the message until it arrives at its destination.

This would seem like a pipedream if it were not for the fact that several networks already operate like this. The computers on the Fidonet and the Internet rely on their neighbors to pass on E-mail, news articles, and other messages. The catch is that the Internet and the Fidonet use the airwaves. This would seem like a pipe dream if it were not for the fact that several networks already operate like this. The computers on the Fidonet and the Internet rely on their neighbors to pass on E-mail, news articles, and other messages. The catch is that the Internet and the Fidonet use the airwaves. This would seem like a pipe dream if it were not for the fact that several networks already operate like this. The computers on the Fidonet and the Internet rely on their neighbors to pass on E-mail, news articles, and other messages. The catch is that the Internet and the Fidonet use the airwaves.

Overcoming the Odds
A number of technical problems stand in the way of the success of the TAL idea; however, they are not insurmountable. The biggest one is cooperation. All the computers and their transmitters must ensure that they don’t step on a signal of another system. Protocols must be designed so that a computer uses the minimum amount of power necessary to reach its neighbors—more power disturbs more people. And the system must design routing networks to make sure that messages are not replicated or sent throughout the network, adding clutter.

Each of these problems has been solved in the laboratory, and it’s only a matter of time before networks like TAL’s are available to the public. In the meantime, the WINForum (Wireless Information Network) is developing etiquettes for the PCS bands.

There are even more fundamental limitations to a network like the one proposed by TAL, though. The bandwidth of the radio spectrum is more limited than the bandwidth of wires and fiber-optic cables. Telephone companies are already proposing test systems that will allow each home to receive video on demand. The airwaves cannot begin to approach this level of information flux.

TAL has a bigger dream of putting a transceiver on every home.

Peter Wayner is a BYTE consulting editor based in Baltimore, Maryland. You can contact him on BIX as "pwayner."

Microsoft Windows Sound System. You’ll be hearing a lot about it.

It’s the complete audio solution for your business, with all the hardware and software included. Call (800) 426-9400, Dept. JK8, for a free demo disk that’ll bring the Microsoft Windows Sound System to life on your PC. It’s the first audio system specifically designed for the Microsoft Windows operating system. Making it easier.

*Requires the Windows operating system 3.1 or later. Demo is on a 3.5-inch high-density disk. Offer good while supplies last. Inside the 50 United States, call (800) 426-9400, Dept. JK8. For information only. In Canada, call (800) 366-9044, excluding the United States and Canada, call 0206 836-8663. © 1992 Microsoft Corporation. All rights reserved. Printed in the USA. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.
The Winning Streak Goes On!
You may have won:
• Fully-loaded 386SX Notebook from GRiD Systems
• Scientific Calculator
• $10 or $20 off your next Shop purchase of $249 or $399, respectively

Your Winning Streak Prize Code is: BP1SL. Call for your prize and official game rules. Winning Streak is back by popular demand, with valuable prizes and cash discounts for Programmer's Shoppers. Call 1-800-421-8006 for your prize and more information, then head to your fax machine for a free Priority Pass to SD '93, the place where the industry happens. Test drive new and updated products from 200+ companies who cater to developers, and lots more. To get your free Priority Pass to SD '93, call (617) 740-0025 from a fax machine and enter SHOP-093 when asked for a FastFaxes number.

WATCOM SQL Developer's Edition
by WATCOM
New Product--Special Introductory Offer. Complete client/server development tool allows you to develop and deploy single-user standalone applications, and to develop applications for use with the Network Server Edition (sold separately). Includes: Single-user database server (both 16- and 32-bit versions); ACME application development system; Embedded SQL/400 preprocessor; SQL libraries for WATCOM C, C/386, MS C/C++ and BC/C++.
LIST: $795 PS Price: $379
FastFaxes 1044-035

High C/C++ v3.0
by MetaWare Incorporated
MetaWare Incorporated introduces its newest product, the 32-bit High C/C++ compiler, version 3.0. High C++ is a true compiler, not a C to C++ translator. "Incremental Strengths" lets you specify the level of C++ compilation, allowing you to migrate from C to C++ one C++ block at a time. Included in the package is a C++-taught source level debugger, and a 32-bit Application Development Kit for Windows. MetaWare offers a full line of multi-language, multi-platform compilers for professional software developers.
LIST: $795 PS Price: $749
FastFaxes 89-046

Distinct TCP/IP for Windows
by Distinct Corporation
Distinct TCP/IP for Windows SDK extends the TCP/IP and RPC/ODR networking capabilities to Microsoft Windows. Includes the smallest and fastest DLLs today available for Berkeley Sockets, RPC, Telnet, and FTP. Cxists on the same board with Lan Manager, Novell and Banyan. Supports Packets, NDOS and OSI drivers. Only 5KB of DOS memory required.
(SDK) LIST: $495 PS Price: $439
(Application) LIST: $595 PS Price: $579
FastFaxes 1951-003; (SDK), 1951-007; (App.)

WATCOM C9.0/386
by WATCOM
Develop and debug 32-bit applications for extended DOS, Windows and OS/2 2.0. Includes royalty-free 32-bit DOS extender, true 32-bit Windows GUI Application Kit, our fast, tight, and reliable 32-bit Code Optimizer, licensed Microsoft Windows SDK Components, an interactive Source-Level Debugger, an Execution Profiler and more! Now includes OS/2 2.0 support.
LIST: $895 PS Price: $599
FastFaxes 1044-029

SVS C3 ANSI C, Pascal, or FORTRAN-77
by Silicon Valley Software
Only from the Programmer's Shop! ANSI compliant, optimizing, 32-bit compilers; DPMI-compliant, royalty-free DOS extender; source level debugger; utilities. Supports "flat model" code. Linker, librarian, make, i386 emulation, W31/4167 support. Interoperable language! Call: 415-572-8800
LIST PS Price
ANSI C $325 $315
Pascal $325 $315
FORTRAN $395 $375
FastFaxes 1958-048; (C), 1958-050; (Pascal), 1958-049; (FORTRAN)

The PKWARE Data Compression Library
by PKWARE
The PKWARE Data Compression Library allows software developers to add data compression technology to applications. The application program controls all data I/O, allowing data to be compressed or extracted to any device or area of memory. Only 35K of memory is needed to compress data, and only 12K is needed to extract data. Compatible with MSG, BC++, TC, TP 6.0, Clipper, Basic 4.5, 7.1, ASM.
LIST: $295 PS Price: $275
FastFaxes 3043-011

To Order Call THE SHOP 1-800-421-8006
...the Programmer's Shop gives you all three. Shop the Shop.

Visual Basic for DOS
by Microsoft Corporation
Draw forms, controls; write event procedures; create custom controls—in DOS! Create new apps or combine with existing C/C++ or Pascal code. Highly compatible with Visual Basic for Windows. Run existing Quick Basic/Basic-PDS code on 80x86 compiler creates 100% standalone .EXE files; 386 code generation; MOVE overlays; an integrated ISAM and much more.

LIST PS Price
PRO $495 $339
Standard $199 $139
FastFacts 302-408 (PRO), 302-407 (Stand.)

Visual Basic for Windows 2.0
by Microsoft Corporation
When you need to create a Windows application quickly, nothing offers the sheer productivity of Microsoft Visual Basic 2.0, Professional Edition. A visual development environment, flexible programming language, and fast runtime execution make this the shortest route to full-featured Windows applications. The Professional Edition includes messaging and data access capabilities, a wide variety of add-on tools, and more.

LIST PS Price
PRO $495 $399
Standard $199 $139
FastFacts 502-443 (PRO), 302-431 (Stand.)

Star Trek™: The Screen Saver
by Berkeley Systems
Beam aboard the Enterprise™ with Captain Kirk and Mr. Spock on a mission to prevent screen burn-in. Encounter tribbles, Klingon battlecruisers, and burrowing horta. This all new screen saver provides over 15 animated displays, password protection, SystemIQ and full compatibility with After Dark.

LIST: $60 PS Price: $39
FastFacts 2900-007

Q+E Database Library
by Pioneer Software
Q+E Database Library provides complete database connectivity to Windows and OS/2 applications using Dynamic Link Libraries. QELIB can read, insert, update, create or delete database records for the following database formats:trieve, dBASE II, Excel files, INGRES, NetWare SQL, Oracle, OS/2 DBM, Paradox, SQL/400, SQ.LBase, SQ.L/DS, SQL Server, Sybase, Tandem NonStop SQL, text files, and XDB.

LIST: $399 PS Price: $339
FastFacts 2137-012

WindowsMAKER™ Professional
by Blue Sky Software™
Considered the easiest and fastest way to create MS-Windows applications in C/C++. Generate the Windows .EXE complete source & production files (no royalties). Just Point & Click to define the Windows user interface. Let you animate your design so that you can test look & feel and make changes on the fly without needing to compile. Custom code is preserved during code regeneration. The leading development tool for Microsoft Windows. Highly Recommended.

LIST: $995 PS Price: $895
FastFacts 2001-006

ProtoGen 3.0
by Protoview
NEW VERSION! The industry standard for code generation and prototyping Windows applications. Develop the user interface of your application using Visual prototyping methods. ProtoGen generates expert level, commented code for ANSI C, Microsoft MFC C++, Borland OWL C++, Turbo Pascal, and Microsoft NT Win32. All generators included! User Code is preserved from one generation to the next. It's easy and fast.

LIST: $199 PS Price: $99
FastFacts 2115-009

Call the Programmer's Shop today: 1-800-421-8006
Mention Code BY293

Canadian customers call 1-800-446-3846

But wait, there's more: Bargains galore!

<table>
<thead>
<tr>
<th>Product</th>
<th>LIST</th>
<th>PS Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>After Dark for Windows</td>
<td>50 28</td>
<td>59 59</td>
</tr>
<tr>
<td>Blinker</td>
<td>299 269</td>
<td>170 109</td>
</tr>
<tr>
<td>Borland C++ 3.1</td>
<td>495 519</td>
<td>495 359</td>
</tr>
<tr>
<td>BTrieve for DOS</td>
<td>595 399</td>
<td>495 329</td>
</tr>
<tr>
<td>Carbon Copy 6.1</td>
<td>199 165</td>
<td>150 99</td>
</tr>
<tr>
<td>Clarion Prof. Developer 2.1</td>
<td>845 469</td>
<td>495 339</td>
</tr>
<tr>
<td>Clipper</td>
<td>795 499</td>
<td>179 139</td>
</tr>
<tr>
<td>DESQview 386</td>
<td>220 149</td>
<td>179 115</td>
</tr>
</tbody>
</table>

Call FastFacts for product information any time, day or night. 617-740-0025.
Create and Deliver Professional Applications with New CA-Clipper

Create And Deliver Professional Applications With CA-Clipper
CA-Clipper consists of a robust language, an efficient linker, flexible preprocessor and high-performance compiler. Together with tools such as an editor, debugger and make utility, these elements form a complete development system for the creation and distribution of professional PC and LAN-based applications.

Only CA-Clipper gives you an open programming environment with high-level networking, data entry and database support. The extended memory system capability of CA-Clipper gives you additional power to build faster, more sophisticated applications.

CA-Clipper Shatters DOS Memory Barriers
• Dynamic overlay management lets you run applications that exceed available RAM—without the need to manually create overlays.
• Virtual memory management allows applications to have up to several megabytes of strings and arrays.

Open Architecture: Freedom to Grow
• Customize CA-Clipper with user-defined commands and functions.
• Build generic libraries to eliminate repetitive programming tasks.
• Build specialized libraries for applications such as accounting, real estate and personnel.
• Seamlessly integrate modules from languages such as C, Assembler, dBASE and Pascal.
• Access data transparently from foreign data sources with Replaceable Database Drivers and function libraries (available separately), including data on LAN database servers and mainframes via gateways.

Simplicity and Control: The Optimal Balance
• Descriptive function/command names and concise operators promote language fluency.
• Syntax ranges from simple, expressive commands to precise string and file primitives for minimal programming with maximum control.
• CA-Clipper promotes disciplined, modular programming for easier debugging, simplified maintenance and greater code reusability.
• High level "objects" simplify the construction of sophisticated interfaces. Build pop-up and pull-down menus, custom BROWSEs and text editors quickly and easily.

Open Networking: Freedom to Connect
• Create and distribute multiuser applications without LAN Packs or workstation licenses.
• Applications run on all networks which support MS-DOS 3.1 and higher.
• Modest memory requirements allow smooth operation with even the largest network shells.

PC Magazine Editor's Choice
CA-Clipper, version 5.01 received the PC Magazine Editor's Choice award for Xbase Development Systems in May 1992.

CA-Clipper 5.2 requires an IBM PS/2, XT, PC or its compatibles; 640K RAM; expanded memory requires LIM 3.2 or higher; hard disk required for development; DOS 3.1 or higher; works with all networks compatible with DOS 3.1 or higher.

Free Distribution of Applications
• CA-Clipper produces executable applications (EXEs) that you may distribute without additional cost.
• Multiuser CA-Clipper applications require NO licenses, NO runtime fees and NO LAN Packs.

Capacity
• Procedures per application: unlimited.
• Functions per application: unlimited.
• Array size: 4,996 elements per dimension, unlimited dimensions.
• Expanded Memory use: 0 to 32 MB.
• Virtual memory: up to 64 MB (main memory, expanded memory, hard disk space); up to 16 MB of object memory (character strings, arrays); up to 9 MB (main memory, expanded memory) for database buffering.

Supplied Database Driver (DBF Format)
• 1 billion records per data file.
• 1,000 fields per record.
• Over 200 open data files (limited to file handles).
• 15 active indexes per open data file.
• Character fields (fixed length): 65,536 characters.
• Numeric fields: 30 digits, precision up to 16 significant digits.
• Support for logical fields (true/false).
• Date fields: 01/01/00-12/31/2999.
• Memo fields (variable length): 65,536 characters.

System Requirements
CA-Clipper 5.2 requires an IBM PS/2, XT, AT, PC or its compatibles; 640K RAM; expanded memory requires LIM 3.2 or higher; hard disk required for development; DOS 3.1 or higher; works with all networks compatible with DOS 3.1 or higher.

For a limited time only!
Clipper users can upgrade to version 5.2 for only $139. A competitive upgrade is also being offered for a limited time to all Xbase system users for only $179, and you'll receive a free CA-dBFast, CA-Clipper Tools or CA-Clipper/Compiler Kit for dBASE IV (your choice).

To qualify for the competitive upgrade, fax a copy of your manual cover to 617-749-2018.

To order, call the Programmer's Shop at 800-421-8006. Hurry, time is of the essence. Call to place your order today. Mention Code BY293.

To Order Call THE PROGRAMMERS SHOP 1-800-421-8006
COMMUNICATIONS GET PERSONAL

AT&T unveils its plans
for the personal communications revolution

BOB RYAN

Hand-held systems such as Apple's Newton are advancing a vision of computing that sees the personal computer not as a miniature mainframe but as an intelligent, highly sophisticated personal communications device. Behind this view are a number of technologies—wireless communications, low-power processors, object orientation, and advanced integration—that are falling into place. Also important is the realization that these machines don't have to be compatible with desktop computers: They just have to be able to communicate with them.

With a personal communications device, you carry the computer and communications services (or your connections to them) in your pocket. The Newton made its big splash last summer (see the text box "Apple's PDA Vision" on page 170). Now AT&T—Apple's former partner in developing a low-power processor—has weighed in with its own vision of the future of personal communications.

The Computer as a Telephone
In conjunction with Go Corp., AT&T has recently entered the personal communications arena in a big way. AT&T and Go hope to establish their view of personal communicators as a standard platform for personal communications devices.

As you might expect, AT&T takes a slightly different approach to personal communications devices than does Apple. According to Rakesh Sood, director of marketing of personal communications systems for AT&T Microelectronics, the AT&T-Go initiative takes as much or more of its content from the telephone as it does from the computer: "The primary application is personal messaging, such as fax,
E-mail, and voice. Voice is a critical component. AT&T set out to create a platform that could handle all types of messaging, from paging to voice mail. The result is the personal communicator.

For the joint initiative, AT&T supplies the basic hardware components; a processor and support chips designed for high-speed, low-power operation; and some custom chips that support modem and voice applications. Go supplies the system software—a version of its PenPoint operating system written for the AT&T processor.

PenPoint is a 32-bit, object-oriented, multitasking operating system built from the ground up to support pen-based computing (see “The Point of the Pen,” February 1991 BYTE). Because PenPoint is object-oriented, a PenPoint application has access to the operating system’s code and to the code of other applications. This code sharing is critical to personal communicators, because it cuts down on memory requirements, which in turn reduces the size and power requirements of a system.

PenPoint’s design is tailored for communications. Support for immediate and deferred communications is built into the operating system.

Even though PenPoint is a known quantity with a small but growing software base, the hardware side of the personal-communicator equation is new. At its heart lies the Hobbit, a new, low-power, high-performance processor from AT&T.

A Processor for C

The Hobbit (which was formerly called the ATT92010) grew out of Bell Labs’ efforts to develop a computer architecture to complement the C programming language. Dubbed CRISP (C Rational Instruction Set Processor), the architecture was originally designed to optimize the performance of programs written and compiled in C. The first silicon implementation of CRISP came in 1986, and development has continued ever since. But in the past few years, the CRISP design specification has been expanded to include low-power performance. The ATT92010 is the first commercial manifestation of the CRISP architecture.

Beyond the fact that it’s a 32-bit microprocessor fabricated with a 0.9-micron double-metal CMOS process, the Hobbit bears little resemblance to the RISC and CISC processors that dominate desktop computing. Most processors—including all RISC and CISC chips—use a register-to-memory architecture. The processor loads an operand into a register before acting on it with an instruction. After processing, the result—usually a modified operand—is written from the register back to memory. The Hobbit, on the other hand, uses a memory-to-memory architecture. This means that it has no registers that are directly accessible to a programmer.

Caching the Stack

Early on in the development of CRISP, AT&T researchers found that roughly 5 percent of all C language instructions were either procedure calls or returns and that nearly half the execution time of register-oriented machines involved procedure-call overhead. Beyond this overhead, most instructions were simple, with branching instructions being the most common. These facts shaped the design of CRISP: A C-rational processor had to have low procedure-call overhead and a reduced penalty for branches.

While an operand stored in a register can be accessed at least an order of magnitude
Discover why FoxPro, Clipper, and dBASE were all written in C.

There is a good reason why your database language was developed in C. In fact, there are many good reasons.

C code is small. C code is fast. C code is portable. C code is flexible. C is the language of choice for today’s professional developer. With the growing complexity of database applications, C is a realistic alternative. Now with CodeBase 5.0, you can have all the functionality, simplicity and power of traditional database languages together with the benefits of C/C++.

C speed - fast code, true executables...
FoxPro, Clipper, and dBASE were written in C primarily for speed. But those compilers don’t really compile, they combine imbedded language interpreters into your .EXE. Now that’s slow. For dazzling performance you need the true executables of C. With CodeBase you get the real thing, C code. Consider the following statistics, from the publisher of Clipper:

**Sieve of Erastothenes**
Benchmark for Prime Number Generation
Shows C to be incredibly faster!

C size - small executables, no added overhead...
FoxPro, Clipper and dBASE would like you to believe you need their entire development system to build database applications. But remember, those products are all written in C. So why do you need to lug all their extra code around? You don’t. CodeBase is a complete DBMS, in C. No fat executables stuffed with unused code. No runtime modules. No royalties. Just quality C code. CodeBase is just what you need.

C portability - ANSI C/C++ on every hardware platform...
No other language exists on more platforms than C/C++. Why rewrite your entire application for DOS, Windows, Windows NT, OS/2 or UNIX? With CodeBase the complete C source code is included, so you can port to any platform with an ANSI C or C++ compiler. Now and in the future.

dBASE Compatible data, index and memo files...
You want the industry standard. You need compatibility. Sure, dBASE is the standard, but every dBASE compatible DBMS product uses its own unique index and memo file formats. Only CodeBase has them all: FoxPro (.cdx), Clipper (.ntx), dBASE IV (.mdx) and dBASE III (.ndx). Now it’s your choice, we’re compatible with you.

**Announcing CodeBase 5.0**
The power of a complete DBMS, the benefits of C

NEW - Multi-user sharing with FoxPro, Clipper and dBASE...
Now your multi-user C/C++ programs can share data, index and memo files at the same time as concurrently running FoxPro, Clipper and dBASE programs. No incompatibilities. No waiting.

NEW - Queries & Relations 1000 times faster...
You can query related data files with any logical dBASE expression. Our new Bit Optimization Technology (similar to FoxPro’s Rushmore technology) uses index files to return a query on a 1/2 million record data file in just a second. Automatically take advantage of this query performance by using our new CodeReporter:

To use CodeReporter, simply draw your report, then include it in any program you write. Call 403/437-2410 now for your FREE working model of CodeReporter.

New - Design complex reports in just minutes...
Our new CodeReporter takes the painstaking work out of reports. Now simply design and draw reports interactively under Windows 3.1, then print or display them from any DOS, Windows or UNIX application.

SPECIAL - FREE CodeReporter
Order CodeBase 5 before Feb. 28, 1993 and receive CodeReporter for free! This offer includes our no-risk, 90-day money back guarantee, so order today!
faster than one stored off-chip, registers are big contributors to procedure-call overhead because their state must be saved across such calls. Thus, for a C-rational processor, general-purpose registers just didn’t make sense.

The Hobbit avoids the drawbacks of general-purpose registers by using an on-chip 256-byte stack cache for fast processor access to operands. The top of the user stack is on-chip, greatly reducing the overhead required to perform procedure calls and returns, which normally store parameters on the stack. A standard processor would have to store one set of parameters from registers to the stack and load a second set from the stack whenever a program initiated a procedure call. The stack cache eliminates these loads and stores.

The stack cache is organized into a circular buffer of 64 32-bit hardware registers. It’s as fast as a general-purpose register file, but like a cache, it resides logically in the system memory-address space. The stack cache is transparent to software, so its size can be increased in future versions of the Hobbit without sacrificing software compatibility.

**Hobbit Plumbing**

Its lack of general-purpose registers aside, the Hobbit borrows features of its design from both the CISC and RISC architectures. Like CISC processors, its instruction set supports multiple addressing modes, and individual instructions can access up to 2/3 memory locations—two memory-based operand reads and a write to the accumulator. Such complex, variable-length instructions permit higher code density than RISC processors, an important consideration when you’re coming up with a processor for portable devices.

From the RISC world, the Hobbit borrows pipelines. The core of the Hobbit consists of two independent three-stage pipelines: a prefetch/decode unit and an execution unit (see figure 1). The latter is loosely coupled to the former by a decoded instruction cache. The prefetch/decode unit takes instructions from the prefetch buffer cache and decodes them into 192-bit instructions for the execution unit. The execution unit reads decoded instructions from the decoded instruction cache, retrieves the necessary operands from the stack cache or from off-chip, and stores the result.

Pipelines work best when the flow of a program is linear, but such is not the case with C programs. Early in the CRISP project, AT&T discovered that up to one-third of all instructions in C programs run on VAXes were branching instructions (the VAX was used as a benchmark because, unlike load/store machines, it uses complex, multioperand instructions). A mechanism was needed to deal with all the branch instructions that the Hobbit would be faced with.

To do this, AT&T uses **branch folding**. Every instruction in the decoded instruction cache contains two 32-bit fields that can hold the addresses of possible successor instructions. The logic to calculate these addresses is located on the input side of the decoded instruction cache. Thus, every instruction placed in the cache is a
The VESA Local Bus Has Arrived!

WindowsVGA 24 (Model 8500VL) - Fast 24-bit graphics accelerator at 32-bit speed. 16.8 Million colors at up to 640 x 480 and 64K colors with up to 800 x 600 resolution. 1MB DRAM display memory. VESA, IBM VGA, EGA, CGA, MDA and Hercules compatible. Advanced drivers include AutoCAD®, AutoShade™, Lotus® 1-2-3, OS/2® 2.0, Microsoft Windows™ 3.1, and more. FlickerFree™ 70 or 72Hz vertical refresh rate. Two year warranty.

TurboExpress 486VL - Fast motherboard performance (300% increase over ISA bus) incorporating the latest in VESA Local Bus technology. Supports up to 50MHz and 256 cache. CPU - 486 SX-20, 25 / 486 DX-33, 50 / 486DX2-50, 66 combinations. Seven 16-bit expansion slots consisting of two VESA local bus slots. Two year warranty.

<table>
<thead>
<tr>
<th>Accelerator / Driver Combination</th>
<th>Winmark (16.8 Million colors in 640 x 480 Resolution*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genoa Model 8500VL with Genoa Driver</td>
<td>2.159 Million</td>
</tr>
<tr>
<td>S3 86C805 Adapter + S3 Driver</td>
<td>0.828 Million</td>
</tr>
</tbody>
</table>

*Benchmark results were collected using 640 x 480 resolution in 16.8 Million color mode, Winbench 3.1 on a 486DX/33 VESA local bus. Other Colors and resolutions will vary. ©Genoa Systems Corporation 75 East Trimble Road, San Jose, CA. 95131 all rights reserved. TurboBahn, TurboExpress and WindowsVGA are trademarks of Genoa Systems. All other registered trademarks and un-registered trademarks are the property of their respective owners. Specifications are subject to change without notice.

Circle 81 on Inquiry Card (RESELLERS: 62).
branch instruction, because it contains the addresses of all possible follow-on instructions. If during instruction decoding a nonbranching instruction is followed by a branching one, the two are "folded" into a single instruction in the decoded cache.

The execution unit consists of an effective-address calculation stage; an operand fetch stage; and an execution stage, where the operands move through the ALU and the results are stored to the stack cache or to memory. In the final stage, four comparitors check the destination address of the executing instruction against the addresses of the operands of the instructions in the first two stages of the pipeline.

If the destination address is accessed by one of the two following instructions, the computed value is passed from the ALU back to the correct stage in the pipeline, satisfying the data dependency without stalling the pipeline. AT&T calls this procedure read canceling, because the presence of the passed-back value eliminates the need for a follow-on instruction to perform a read to acquire the operand (see figure 2).

The Supporting Cast
The Hobbit is the centerpiece of a new family of chips from AT&T designed for use in personal communicators. Other members of the family are the ATT92011 SMD (System Management Device), the ATT92012 PCMCIA Interface Device, the ATT92013 P-ISA Interface Device, and the ATT92014 Display Controller. All these PCS (personal communication services) devices can interface with the Hobbit, run at 3.3 V or 5 V, and provide 3.3- to 5-V translation.

The SMD handles bus arbitration and power management; generates the system clocks; and contains an asynchronous serial port, a keyboard/pen port, 256 bytes of battery-backed SRAM (static RAM), and a real-time clock. The SMD's power management functions are impressive: It can selectively shut down parts of the system (including the Hobbit) that aren't in use or shut down the entire system (including itself) until it receives an interrupt from the real-time clock or gets an on/off signal. The SMD can also refresh DRAM during a shutdown.

The other three PCS devices control communications with peripherals. The P-ISA Interface Device provides a connection between the Hobbit CPU bus and a peripheral bus that is a subset of the ISA bus. This subset doesn't support bus masters and limits DMA and interrupt functions. The PCMCIA controller handles connections to three PCMCIA slots. The controller supports PCMCIA 2.0.

The video display controller lets the Hobbit drive color and gray-scale LCDs. It supports three display sizes—640 by 480, 640 by 480, and 1024 by 768 pixels—and up to nine gray levels. The top gray level is used to display the ink of a pen-input device. The controller also has built-in support for 17 dither patterns (16 for the display plus one for ink). Color displays are able to use nine color patterns out of a palette of nearly 5000 patterns. The controller can also drive CRT displays using an external RAMDAC.

Moving Targets
With this foundation, AT&T hopes to create a dynamic environment for independent hardware vendors and OEMS. Development systems and software development tools have been available since last year. AT&T anticipates that a wide range of systems will be designed around the base platform and that systems will become less expensive and more capable.

Over the next few years, AT&T will concentrate much of its effort toward integrating the functions of the Hobbit support chips onto the same die as a processor. In addition, communications, compression,
Come and get it.

The new Amiga® 3000T multimedia workstation tower—the most expandable, flexible Amiga ever built.

Now powered by a 25 MHz Motorola 68040 CPU, the A3000T is faster than ever before. (Current A3000T users can upgrade to a 040-based accelerator card.)

The A3000T features a 200MB hard disk drive. A 3.5" floppy disk drive. 5MB of RAM, expandable to 18MB. And 32-bit bus architecture to transfer mammoth amounts of information at breakneck speed. The truly power famished will be happy to know that the A3000T is stuffed with an abundant selection of expansion slots. There's a co-processor slot. A video slot for internal devices. Up to four PC slots. And up to five Zorro III slots. Every Amiga 3000 series computer comes with Commodore Express™ Gold Service options.* And convenient leasing terms are available.

Now, you'd expect a power feast like this to carry a fat price tag. But now with our new low price, you can sit down to an Amiga 3000T for just $2,875.** Which in itself is a powerful reason for seeing your Commodore dealer today. For a dealer near you, call 1-800-66-AMIGA. In Canada, call 1-800-661-AMIGA. Bon appetit.
COMMUNICATIONS GET PERSONAL

Figure 3: AT&T expects that the effects of integration and market forces will make this year’s high-end personal communicators the low-end systems of 1995. (Courtesy of AT&T Microelectronics)

The 440 is a tablet measuring 7.1 by 10.8 inches and weighing, in the basic configuration, 2.2 pounds (see photo 1). It uses a 20-MHz Hobbit and comes with 4 MB of RAM and 8 MB of ROM. All software is in ROM. The 440 has a PCMCIA Type 2 slot for expansion; a microphone and speaker for voice annotation; and serial, parallel, keyboard/pen, and phone ports for communications. One option you can add is a V.32bis data modem, which gives you 14.4-Kbps data transmissions and 9600-Kbps send/receive fax capabilities. You can also add 8 MB of RAM to the system and a 20-MB Hewlett-Packard Kittyhawk 1.3-inch hard drive.

The 880 is larger than the 440, measuring 9 by 13 inches, with a 5.7- by 7.6-inch backlit display that weighs 4 pounds. In addition to the standard features found in the 440, the 880 offers an internal modem and VGA and SCSI-2 ports. The optional hard drive for the 880 is a 1.8-inch IDE unit.

In addition to the PenPoint operating system, the 8 MB of ROM contains PenSoft’s Perspective, a personal information manager; GoFax and GoMail, from Go; PenTops from Sitka; and several utilities. The package also includes a subscription to AT&T Mail. Both the 440 and the 880 can be outfitted with optional cellular adapters and cellular phones. The basic price for the 440 is $1999; the 880 costs $2999.

The EO systems are significant not only for the capabilities they offer but for the direction they take. Serious communications capability is built into every system, and wireless communications—in the form of analog cellular—and voice are options. As the technologies mature, you can expect these capabilities to be incorporated into the base system and that EO or third parties will offer digital cellular and packet-switched radio options for the machines. In addition, battery performance will improve dramatically as more 3-V peripherals become available. Although the core and memory of the 440 and the 880 operate at 3 V, most of the peripherals operate at 5 V.

There and Back Again

AT&T’s personal communicator is a bold attempt to bring the power of computers to bear in personal communications. As with any new technology, the first year or so will see trade-offs, as manufacturers try to balance the conflicting needs of portability and advanced communications capabilities.

As digital-cellular and packet-switched-radio technologies mature and more 3-V peripherals become available, the conflicts between portability and capability will lessen, and personal communicator systems will provide both qualities. The changes that they will bring to the way you work and play cannot be predicted, but they will be impossible to ignore.

Bob Ryan is a BYTE technical editor. You can reach him on BIX as “b.ryan.”

Handwriting recognition, and other custom functions could also be integrated onto the processor chip (see figure 3). Offerings from OEMs are scarce. But EO (Mountain View, CA) plans to ship two personal communications systems—the 440 and 880—by the time you read this.

Photo 1: The EO 440’s screen is a standard 640- by 480-pixel VGA display with 110-dot-per-inch resolution. Shown is the optional CellPhone module, which lets the internal modem work over the cellular telephone system.
For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

Yes, I want FREE information on the following products!

1. Circle the Numbers on Your Direct Link Card

Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address

Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!
YOUR DIRECT LINK CARD

For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

1. Circle the Numbers on Your Direct Link Card
   Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address
   Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!
Plugging into Wireless

The world of wireless and mobile computing includes telecommunications companies, computer manufacturers, hardware and software vendors, and service providers. The companies below represent a cross section of the eclectic wireless data communications industry.

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Makes the Newton PDA (Personal Digital Assistant).
Circle 1146 on Inquiry Card.

Ardis
300 Knightsbridge Pkwy.
Lincolnshire, IL 60069
(708) 913-1215
A joint venture of Motorola and IBM that provides large companies with nationwide wireless data communications.
Circle 1147 on Inquiry Card.

AT&T Microelectronics
Personal Communications Systems
4994 Patrick Henry Dr.
San Jose, CA 95134
(408) 856-9800
(415) 856-9800
Transmission capability to 880 personal communicators and makes the Hobbit processor.
Circle 1150 on Inquiry Card.

CDI (Cellular Data, Inc.)
2860 West Bayshore Rd.
Palo Alto, CA 94303
(415) 856-9800
Provides digital data transmission capability to cellular phone systems.
Circle 1149 on Inquiry Card.

Cue Network Corp.
2737 Campus Dr.
Irvine, CA 92715
(714) 752-9200
Provides one-way wireless E-mail connections to the Sharp Wizard.
Circle 1150 on Inquiry Card.

EO, Inc.
800A East Middlefield Rd.
Mountain View, CA 94043
(415) 903-8100
fax: (415) 903-8190
Markets the EO 440 and EO 880, personal communicators based on the AT&T Go hardware/software platform.
Circle 1151 on Inquiry Card.

Ericsson GE Mobile Communications, Inc.
15 East Midland Ave.
Paramus, NJ 07652
(201) 265-6600
Markets the Mobileden, an RF modem for Mobitex networks.
Circle 1152 on Inquiry Card.

Ex Machina, Inc.
45 East 89th St., Suite 39A
New York, NY 10128
(718) 965-0309
fax: (718) 832-5465
Provides software link between paging receivers and Mac, DOS, and Windows computers.
Circle 1153 on Inquiry Card.

Go Corp.
919 East Hillsdale Blvd., Suite 400
Foster City, CA 94404
(415) 358-2000
fax: (415) 345-9833
Maker of the object-oriented PenPoint operating system.
Circle 1154 on Inquiry Card.

Granite Communications
9 Columbia Dr.
Amherst, NH 03031
(603) 881-8566
fax: (603) 881-4042
Provides in-building mobile wireless systems.
Circle 1155 on Inquiry Card.

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
(800) 752-0900
(415) 857-1501
Maker of the HP 95 line of hand-held computers.
Circle 1156 on Inquiry Card.

Individual, Inc.
84 Sherman St.
Cambridge, MA 02140
(800) 766-4224
fax: (617) 335-2230
Supplier of the Heads Up information service for EMBARC.
Circle 1157 on Inquiry Card.

Mainstream Data
420 Chipeta Way, Suite 200
Salt Lake City, UT 84105
(801) 584-2800
Provides for FM and satellite reception of its news services.
Circle 1158 on Inquiry Card.

Microcom, Inc.
500 River Ridge Dr.
Norwood, MA 02062
(800) 822-8224
fax: (617) 551-1000
(617) 551-1021
Developers of MNP level 10, a data communications protocol for cellular communications, and makes the MicroPorte portable modem.
Circle 1159 on Inquiry Card.

Motorola Paging and Wireless Data Group
EMBARC/Motorola
1500 Northwest 22nd Ave.
Boynton Beach, FL 33426
(407) 364-2000
The Paging and Wireless Data Group produces the NewsStream information receivers. EMBARC provides a nationwide paging system that can connect to E-mail services.
Circle 1160 on Inquiry Card.

Motorola RadioWare Solutions Group
1201 East Wiley, Suite 103
Schaumburg, IL 60173
(800) 233-0877
fax: (708) 632-4723
Produces WaveGuide 2.0, an API for Windows that lets developers create applications that can access the Ardis and RAM Mobile Data networks.
Circle 1161 on Inquiry Card.

Qualcomm, Inc.
10535 Sorrento Valley Rd.
San Diego, CA 92121
(619) 587-1121
Provides satellite-based data communications and developed CDMA (code division multiple access) technology for digital cellular communications.
Circle 1162 on Inquiry Card.

Radiomail
P.O. Box 1206
Menlo Park, CA 94026
(415) 326-5615
Provides gateway services between wireless communications systems and the wirebound data communications infrastructure.
Circle 1163 on Inquiry Card.

RAM Mobile Data
10 Woodbridge Center Dr., Suite 950
Woodbridge, NJ 07095
(908) 602-5500
fax: (908) 602-1262
A joint venture of RAM Broadcasting and BellSouth, it operates the wireless Mobitech-based RAM Mobile Data network in the U.S. and the U.K.
Circle 1164 on Inquiry Card.

SkyTel
1350 1 St. NW
Washington, DC 20005
(202) 408-7444
Provides nationwide paging services.
Circle 1165 on Inquiry Card.

Zyxel USA
4920 East La Palma Ave.
Anaheim, CA 92807
(714) 693-0808
fax: (714) 693-0705
Manufactures cellular and standard modems.
Circle 1166 on Inquiry Card.
Network fax servers bring computer fax to every desktop

RAYMOND GA CÔTÉ, STEVE APIKI, AND STAN WSZOLA

Fax is the superhero among corporate communications channels—faster than overnight mail, more widespread than any E-mail system, and able to transmit graphics information with a single phone call. But it also has some serious flaws, like poor-quality scanned images, no security for incoming documents, and long lines at the fax machine (not to mention curly fax paper).

Computer-based fax has overcome a lot of these limitations, but there's still one area where the office fax machine enjoys a big advantage over a desktop fax system: Fax machines are shareable resources; desktop fax boards are not. Having one or two users who can send and receive faxes without leaving their desks doesn't replace a fax machine that used to serve the entire workgroup, regardless of the fax machine's frailties.

The solution, of course, is to tie together a LAN and a fax. This month's Solutions Focus looks at network fax servers, which promise to put a computer-based fax system (or at least a shared portion of one) on every desktop.

We'll look at 11 of the top players in the fax-server market for PC, Mac, and Unix networks: Alcom's LanFax Redirector 2.1, Calculus's Advanced EZ-Fax for Networks 3.53, Cheyenne Software's FaxServe 1.0, Intel's Net Satisfacxtion Software 2.0, OAZ Communications' NetFax 4.01, Optus Software's Facsys 3.30a, Pure Data's PureFax 3.1, Circuit Research's 4Sight Fax 2.0.3, STF Technologies' Faxstf Net 2.2.3, The Bristol Group's IsoFax 5.1, and Samsung Software America's Replix 1.0. (One familiar name, GammaLink's GammaNet, is not included—the company has abandoned its software products to focus on its hardware line.) Note that each of these is a computer-based system (i.e., they all require a dedicated or nondedicated host machine). In most cases, these systems are less expensive—if somewhat less extensible—than stand-alone fax servers, such as those from Biscom and Castelle.

Client-Server Faxing
From a network client, you use a fax server much as you would use a stand-alone computer fax board. Client utilities usually include printer drivers or print-capture...
WHAT FAX SERVERS ARE
Client-server software packages that share computer-based fax services among network users.

LIKES
Sharing a computer-based fax on a network saves money and countless hours compared to fax machines or a stand-alone computer-based fax; many packages integrate fax with E-mail.

DISLIKES
Routing incoming faxes to users is a problem that awaits a workable solution. Products are often difficult to install and administer, and no package has multiplatform support.

RECOMMENDATIONS
4Sight for Mac networks; Replix for Unix installations; and four PC-based packages with various strengths: LanFax Redirector, Net Satisfaction, Faxserve, and Facsys.

utilities, which let you fax by printing within an application, and full fax applications, which let you fax files and view and print incoming documents. Many also include command-line utilities for automating fax transactions or monitoring fax status.

Whatever the task, the client software executes it by passing along service requests to the fax server, which operates the hardware. Each communications link—between client application and client fax software, between client fax software and fax-server software, and between fax-server software and fax modem—relies on a fragile web of proprietary and standard protocols. The text box “Standards and Practices” on page 182 details some recent industry efforts to standardize communication between applications software and fax hardware for both network and stand-alone fax applications.

There are as many ways to implement a client-server fax system as there are fax servers on the market, but each package fits more or less into one of three configurations (see the figure). The first configuration is peer to peer. In this arrangement, fax-server and fax-client software communicate directly via network-transport protocols (e.g., Novell’s IPX). The benefits of this design are reduced file-server traffic and real-time client-server communication.

In the second configuration, the shared-
FAX SERVERS

NETWORK FAX-SERVER CONFIGURATIONS

a) Peer-to-peer

- Workstation
- Fax server
- Phone line out
- Printer

b) Shared file system

- Workstation
- File server
- Users (Bob, Joe, Steve)
- Incoming
- Outgoing
- Fax server
- Phone line out
- Printer

c) E-mail-based

- Workstation
- Mail server
- Other mail service
- Fax server
- Phone line out
- Printer

Three client-server organizations for network fax servers. (a) Peer-to-peer fax servers communicate with clients directly through network protocols. (b) A shared-directory design uses polling of a shared-file system on the file server for client-server communication. (c) E-mail-based fax servers get faxes from users and send received faxes back via standard mail transports.

file configuration, the fax server and the fax client communicate through reserved directory areas on a file server. For example, a client may write outgoing fax images to a directory called Outgoing on the file server. The fax server polls the directory and sends over the wire whatever files land in the Outgoing directory. The fax server may write incoming faxes to an Incoming directory and, once the faxes are identified, route them to individual user subdirectories. Client modules for each user poll the user directories for incoming faxes. This is a common configuration that makes for simple operation and reduces dependency on specific network operating systems.

The third fax-server configuration is mail-based and relies on E-mail as a transport between clients and server. Clients "mail" faxes for transmission, and the fax server mails incoming faxes to the appropriate user. This scheme works best if the system in your office already relies on E-mail, providing a transparent link between these two methods of communication.

The Ins and Outs of Network Fax

Despite their differences, all 11 packages reviewed here provide LAN clients with three basic capabilities: image conversion, fax transmission, and fax reception. All consist of at least server and client software modules, and all require fax-modem hardware. In some cases, the fax modem is provided with the package (see the table for configuration details), but most require a fax modem in addition to the server software.

Transmitting an electronic fax requires at least two steps. First, the document must be converted into an electronic fax format. Second, it must be transmitted to the destination fax. Some systems perform both of these steps on the server, while others rely on the client for image conversions. In some cases (most notably the Windows printer drivers), imaging is actually a two-step process; documents are converted to one format on the client and then reconverted to a fax format on the server.

All the PC-based packages take advantage of coprocessor-based fax-modem boards such as Intel's Net Satisfaxtion and GammaLink's GammaFax CP to reduce imaging time. These boards convert from ASCII text or bitmap image formats to a Group 3 byte stream without requiring work from the host processor. The Mac and Unix servers use external modems, and the host computer is responsible for all imaging.

Network fax servers' greatest weakness is in routing received faxes. Unfortunately, there is no standard method for specifying the addressee of a fax document through a shared fax system (although the CCITT is working on extending fax
Picture your Hardlock™ key as a bike lock, and the accompanying software routines used to implement the copy protection as the chain. You can own the best lock that money can buy, but that lock is useless if the chain is weak.

Introducing HL-Crypt, a major breakthrough in copy protection. HL-Crypt is not just a shell or simple conditional response checker. Using our proprietary Patcher Technology, HL-Crypt encrypts and binds the application to your Hardlock™ device. HL-Crypt features many protection modules that secure the application against piracy, reverse engineering, and debugging, to name a few.

Picture HL-Crypt as an ironclad chain. The only ironclad chain in the industry today. For more information, call

1-800-562-2543

HL-Crypt

The Fortified Protection Linker for Hardlock
For software developers, the marriage of fax, computer, and LAN has been a difficult one. Unlike data communications, where there are standard methods for writing to hardware, there is no common starting point for working with fax modems.

In 1988, the CCITT TR29.2 standards committee accepted the Class 1 standard for communication between fax software and fax modems. The committee also voted on, but did not accept for technical reasons, the Class 2 standard. Software developers and fax-modem manufacturers decided to unofficially adopt Class 2 until the CCITT could develop an acceptable standard. In an effort to help define a standard, the EIA (Electronics Industry Association) has produced EIA TR.29, which encompasses Class 1, 2, and 3 command sets to standardize the use of fax modems and applications software.

Class 1, the only standard that has been officially issued, defines six commands that a computer can use to send a fax; for example, transmit or receive at 300 bps for parameter negotiations, and transmit or receive at 9600 bps for fax transmission. Class 1 fax software handles all the T.4 fax-image and T.30 session-protocol information and timing.

The Class 1 commands require the minimum amount of hardware to manipulate and send a fax. This means that a Class 1 fax modem requires more CPU and system resources. Sending or receiving a fax with Class 1 fax modems and software typically means that active fax-conversion tasks can't run in the background.

Class 2 fax software generates a T.4 fax-page image and sends it to the fax modem a page at a time. The fax modem then handles the T.30 session-protocol information and timing. The de facto Class 2 commands provide 40 or more extended AT commands and responses to free up PC or server resources. If the Class 3 standard is ever issued, it will allow ASCII-to-fax or other file-to-fax conversion by modems.

**PC APIs**

For PCs, there are three defined methods of communicating with fax hardware: Intel/DCA's CAS (Communications Applications Specification), the FaxBIOS Association's FaxBIOS, and the CCITT's T.611 standard. All three are in contention for the title of standard API.

DCA and Intel released CAS in September 1988. CAS defined a standard communications API for working with Intel's Connection CoProcessor board and its successors, the Net Satisfaction series.

CAS is a high-level software interface for sending and receiving individual fax files and other binary files. The basic unit of transfer in the CAS interface is an entire file. The CAS Resident Manager routines handle all the details of dialing, connection, file transmission, and call termination. Applications communicate with the Resident Manager, which handles everything in the background. The application and the Resident Manager communicate via control files, which record vital information about transmissions (e.g., phone numbers and transmit time). Unfortunately, CAS is not a network API and extending CAS across the network requires redirectors like those reviewed here.

FaxBIOS is an incompatible superset of the services provided by CAS. FaxBIOS is a high-level API designed for platform independence. It has all the capabilities of CAS, as well as networkwide enhancements. In addition, it has features for telephone directory management, graphics services, and low-level I/O-device control. Fax-BIOS also incorporates a DDE interface for Windows.

Intel has not mentioned support for FaxBIOS, but it has announced support for a new API standard called T.Applecon or T.611. The T.611 standard was developed by France's telephone company and has been submitted for CCITT approval. Since T.611 was designed to be downward-compatible with CAS, existing CAS-based applications will work on T.611 modems without modification.

addresses to include routing information). Most fax servers require an administrator to view incoming faxes and route them to users based on visual inspection. EZ-Fax and Faxstf do away with routing altogether by giving users access to all received documents.

However, several methods are available for automatic distribution. DID (Direct Inward Dial), which requires a service provided by the local telephone company, reserves a block of phone numbers for a single phone line. Through DID decoding hardware, the fax server knows which number was dialed and routes the fax to the designated recipient. LanFax Redirector, NetFax, Facsys, 4Sight, and IsoFax all support DID when used with fax modems that provide DID decoding.

A somewhat less complex method of electronic routing uses DTMF signals sent after dialing to route a fax. However, there are no standard DTMF codes, and working effectively with DTMF requires that fax senders know to use the DTMF codes. Again, DTMF requires decoding hardware, which Net Satisfaction, Facsys, and 4Sight support.

Finally, Facsys offers an OCR routing capability. Facsys can scan the first page of a document, looking for a sequence of digits as a routing code. This capability suffers from the same drawbacks as DTMF, in that there is no standard method for including numeric codes on a page. Further, it requires OCR to work reliably on sometimes poorly scanned documents from fax machines.

Given the current state of routing technology and standards, simply printing out incoming faxes is probably still your best bet. Except for Faxstf, all these packages offer the option of routing a copy of incoming faxes directly to a printer. For most packages, printing and routing via an administrator are the only methods we tried.

**The Proving Ground**

We tested each of these fax servers on a test network in the BYTE Lab. For the PC systems, we tested on a Novell NetWare continued
Computing Know How
Learn More with Computer Books from Abacus

Sound Blaster Book
This book is your guide to Sound Blaster, from installation to custom programming. Includes an overview of the different Sound Blaster cards, many specific software products and much more. Also includes simple MIDI system to use with your Sound Blaster.

#184. ISBN 1-55755-164-2. Price $34.95 with 3.5" companion diskette.

The 486 Book
Explains the features that make this processor so advantageous - the memory capabilities, the math coprocessor, the specialized software that maximizes the CPU's performance and more. PCINFO program on companion diskette.


Upgrading & Maintaining Your PC
Shows you how to turn your PC into a hi-performance computing machine. Learn how to add a hard drive, expand memory or turn an XT into a fast AT, 386, or 486 screamer. Shows you how to upgrade easily and economically without having to be an electronics wizard.

#B167. ISBN 1-55755-167-7. Price $34.95 with 3.5" companion diskette.

DOS 5.0 Complete Special Edition
Learn the "ins and outs" of the new DOS 5.0.
- Using the new SHELL, EDIT, DOSKEY, and QBASIC
- Complete comprehensive DOS command reference section
- Includes Tempset software - the graphic shell for DOS 5.0.


PC INTERN
The encyclopedia of DOS programming know how for the professional programmer. Includes parallel working examples in Machine Language, C, Pascal and BASIC.
- DOS and BIOS internal structures and functions
- Programming video cards, sound, TSRs


Wicked Sounds
This outrageous book/disk lets you sit back and have some fun with sound for any of 12 different Windows events: closing a window, etc. Includes Sound DATA BASE manager to organize and identify your growing library of wave forms.

#168. ISBN 1-55755-168-5. Price $29.95 with companion disk including wave forms and Sound Database Manager.

Turbo C++ Step by Step
Teaches you step by step C++, the language of choice among professional developers.
The lessons are designed to be short, progressive and to the point, so you can learn quickly.

#B156. ISBN 1-55755-156-1. Price $34.95 with 3.5" companion diskette. 300 pages.

Windows 3.1 Complete
Learn to optimize & customize Windows 3.1.
- Improve your productivity with built-in Windows applications
- Includes dozens of useful tips and techniques
- Includes two valuable Windows utilities diskettes: Backup & SnapShot


PC Assembly Language Step by Step
Teaches you machine language from the ground up, at your own pace. Learn assembly language using the unique assembly language simulator which shows how each instruction functions as the PC executes it. You'll get hands-on training with this exceptional book/disk combination.


Order Toll Free 1-800-451-4319

Abacus
Dept B, 5370 Grand Street SE, Grand Rapids, MI 49512
Phone: (616) 686-0300 • Fax: (616) 686-0005

For fast delivery Order Toll Free 1-800-451-4319 or FAX (616) 686-0325
Or mail this coupon to: Abacus, 5370 52nd Street SE, Grand Rapids, MI 49512
Method of Payment: □ Visa □ Master Card □ Am.Express □ Check / M.O.

Card#: □ Indicates correct sales tax:
CA & HI orders include correct sales tax.
In US & Canada add $5.00 shipping.
Foreign orders add $13.00 per item.
Total amount (US funds):

Name: □ Yes, please rush your free catalog of PC books and software.
Company:
Address:
City: □ State: □ Zip: □
Phone #: □ Fax #: □
Expires: □

Circle 61 on Inquiry Card (RESELLERS: 62)
Many of the fax-server packages support a variety of third-party fax modems in addition to the hardware listed here. (\(=\) yes; \(\circ\) = no; N/A = not applicable.)

<table>
<thead>
<tr>
<th>PC</th>
<th>Alcol LanFax Redirector 2.1</th>
<th>Calculus Advanced EZ-Fax for Networks 3.53</th>
<th>Cheyenne Faxserve 1.0</th>
<th>Intel Net Satisfaction Software 2.0</th>
<th>OAZ NetFax 4.01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-user system</td>
<td>$995</td>
<td>$1995</td>
<td>$995</td>
<td>$1995</td>
<td>$2490</td>
</tr>
<tr>
<td>Unlimited</td>
<td>$9995</td>
<td>$1799</td>
<td>$995</td>
<td>$1995</td>
<td>$2490</td>
</tr>
<tr>
<td>Hardware included</td>
<td>(\circ)</td>
<td>(\circ)</td>
<td>(\circ)</td>
<td>(\circ)</td>
<td>(\circ)</td>
</tr>
<tr>
<td><strong>Client platform</strong></td>
<td>DOS</td>
<td>DOS</td>
<td>NetWare</td>
<td>DOS</td>
<td>DOS</td>
</tr>
<tr>
<td><strong>Network support</strong></td>
<td>DOS, Windows</td>
<td>DOS, Windows</td>
<td>DOS, Windows</td>
<td>DOS, Windows</td>
<td>DOS, Windows</td>
</tr>
<tr>
<td><strong>Modem support</strong></td>
<td>Class 2, CAS</td>
<td>Proprietary card</td>
<td>Class 2, CAS</td>
<td>CAS</td>
<td>Proprietary board</td>
</tr>
</tbody>
</table>

### Sending Faxes

<table>
<thead>
<tr>
<th><strong>Input file formats</strong></th>
<th>ASCII, PCX, DCX, PCL</th>
<th>ASCII, PCX, CUT, PCL, Group 3</th>
<th>PCX, DCX, BMP, PCL</th>
<th>ASCII, PCX, DCX</th>
<th>ASCII, PCL, TIFF, BMP, Group 3, OAZ fax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Print capture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Font support</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TrueType</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PostScript</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macintosh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X Window System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>PCL</td>
<td>PCL</td>
<td>PCL</td>
<td>PCL, Epson FX</td>
<td></td>
</tr>
<tr>
<td><strong>Phone books</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System phone books</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User phone books</td>
<td></td>
<td>Within system phone book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Priority levels</strong></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Delay sending</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Broadcast fax</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group faxes to one target</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fax imaged on client</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fax imaged on server</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Auto-print outgoing faxes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Retransmit only unsent portion on retry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Receiving Faxes

| **Routing** | | | | | |
| Administrator | | | | | |
| OCR | | | | | |
| DID | | | | | |
| DTMF | | | | | |
| **Auto-print incoming faxes** | | | | | |
| **E-mail connections** | | | | | |
| Unix mail | | | | | |
| MHS | | | Option | | |
| ccMail | | | | | |
| QuickMail | | | | | |
| Microsoft Mail | | | | | |
| **Date/time stamp** | | | | Windows client only | |
| **Invert, size, scale received faxes** | | | | Windows client only | Windows client only |
| **Save as format** | PCX, DCX, PCL | PCX, CUT | Fax only | Fax only | Fax only |
| **OCR** | | | | | |
| **Administration** | | | | | |
| Administration platform | DOS, Windows | DOS, Windows | DOS, Windows | DOS, Windows | DOS |
| **Transmission log** | | | | | |
| **Receipt log** | | | | | |
| **Export transaction log** | | | | | |
| **Fax diagnostics** | | | | | |
| **Privilege levels** | User, router, admin. | None | User, admin. | User, admin., supervisor | User, admin., supervisor |

**Notes:** 8 Eight user \(\circ\) Floating license \(\mathcal{A}\) 250-user maximum \(\mathcal{B}\) Requires DID
## FAX-SERVER FEATURES

<table>
<thead>
<tr>
<th>PC</th>
<th>Mac</th>
<th>UNIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optus Facsys 3.30a PureData</td>
<td>Circuit Research 4Sight Fax 2.0.3</td>
<td>STF Technologies FaxStf Net 2.23</td>
</tr>
<tr>
<td>$995</td>
<td>$999</td>
<td>$999</td>
</tr>
<tr>
<td>$995</td>
<td>$699</td>
<td>$249</td>
</tr>
<tr>
<td>DOS, Windows NetWare</td>
<td>Macintosh, FlexFax Modem</td>
<td>Macintosh, Siemens SendFax</td>
</tr>
<tr>
<td>Intel Satisfaction Proprietary board</td>
<td>Class 1, Class 2, Apple Modem, FlexFax Modem</td>
<td>Class 1, Class 2, Apple Modem, Siemens SendFax</td>
</tr>
</tbody>
</table>

### Features

<table>
<thead>
<tr>
<th>PC</th>
<th>Mac</th>
<th>UNIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII, PCX, DCX, PCL, PostScript</td>
<td>ASCII, TIFF, DCX, PCX, BMP, IMG</td>
<td>TIFF, EPSF PICT, Paint</td>
</tr>
<tr>
<td>BMP, IMG</td>
<td>255</td>
<td>Option</td>
</tr>
<tr>
<td>BMP, PCX</td>
<td>30 formats</td>
<td>BMP, PCX</td>
</tr>
<tr>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
</tr>
<tr>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
</tr>
</tbody>
</table>

**Windows client only**

<table>
<thead>
<tr>
<th>PC</th>
<th>Mac</th>
<th>UNIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
</tr>
<tr>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
</tr>
<tr>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
<td>BMP, PCX</td>
</tr>
</tbody>
</table>

**DOS, Windows**

<table>
<thead>
<tr>
<th>PC</th>
<th>Mac</th>
<th>UNIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>User, admin., router</td>
<td>User, admin., supervisor</td>
<td>User, admin.</td>
</tr>
<tr>
<td>User, admin., router</td>
<td>User, admin., supervisor</td>
<td>User, admin.</td>
</tr>
</tbody>
</table>

**User, admin.**

<table>
<thead>
<tr>
<th>PC</th>
<th>Mac</th>
<th>UNIX</th>
</tr>
</thead>
</table>

**User, admin.**
FAX SERVERS

3.11 network running over NE-2000 network cards on a Compaq Deskpro 66M server. Our standard fax server was a CompuAdd 433 system running DOS 5.0 and Windows 3.1 where appropriate. The Macintosh clients and servers ran on a Mac IIfx and a Quadra 950 running System 7.0.1. All Unix testing was performed on a Sun Sparcstation 2 running SunOS 4.1.2 and Open Windows 3.

We used a wide range of fax modems. Many of the PC packages came with their own hardware; otherwise, we defaulted to an Intel Satisfaction/200 board. We used external modems from Circuit Research and Dove Computer to test Mac fax servers and an Everex EverFax 24/96E (packages that claim Class 2 support all work with the EverFax modem).

To test each server, we transmitted and received a variety of documents. Transmission test documents included a cover page with a bit-mapped BYTE logo, To/From fields, and a one-line message; a 4-KB text file; a full-page bit-mapped TIFF or PCX file; and, from the Windows PC and the Mac, a complex multicolored Word document containing several fonts and images. For each, we noted the time it took and any difficulties in the transmission. For most packages, each transmission was instantaneous from a client perspective.

Besides the quantitative testing, we found that qualitative issues play a big part in determining the quality of fax servers. High-visibility items such as the flexibility of administration and routing tools, the client user interface, and the ease with which faxes could be automated are obviously important, but so are little items like cover-page customization, mixing graphics and text, and sharing user telephone-book databases.

Surprisingly, output fax quality is one area where we found little difference from one package to another. Even though you might expect text images created with TrueType or PostScript fonts to generate cleaner images, there isn't much noticeable difference with normal point sizes on a 200-dot-per-inch high-resolution fax. Graphics, too, showed little difference from fax server to fax server.

Unfortunately, none of these fax servers supports clients on foreign operating systems, so you'll need to choose one that fits your current network platform. We've broken these products into groups based on operating systems in the following evaluations. Note that the mail-based packages (OAZ's NetFax and Circuit Research's 4Sight) and those that offer gateways to E-mail systems can offer some measure of fax interoperability between platforms.

LanFax Redirector 2.1

Alcom's LanFax Redirector does just what its name implies—it redirects CAS (Communications-Applications-Specification)-service requests from fax-client software to a dedicated fax server, using IPX/SPX or NetBIOS as a transport. Its clean architecture, combined with remarkably flexible DOS and Windows client software, makes LanFax Redirector one of the top picks in this review.

We tested LanFax Redirector with an Intel Satisfaction Modem/200, but the software supports any CAS-compatible board, and it can handle up to eight modems in a single server. The CAS-centric approach brings with it some nice features, such as automatic handling of ASCII documents and the ability to send binary data to another CAS modem.

Installing LanFax Redirector is relatively painless. You install the board and run a utility that installs the server software and builds the system databases. Once it's up and running, the server collects CAS requests from clients and processes them through a CAS modem. It also maintains transaction records by user in a central system database administered through Borland's Paradox engine.

LanFax Redirector maintains its own list of authorized users, distinct from the network user list. But, you aren't forced to add users manually. You can configure server software to accept fax requests from any user and automatically add these users to the database. After this initial process, you can switch off the automatic-acceptance feature and manually tweak user rights.

Users may be administrators, users, or routers. Users deal only with their personal queues; routers can view the first page of any inbound fax and forward it to the appropriate queue. Unfortunately, routers can easily circumvent the first-page feature simply by routing the fax to their personal queue and forwarding it later. If security is a critical issue, you can monitor the audit trail that LanFax Redirector maintains.

Users share a central phone book (again, a Paradox-compatible database). Entries are simply flagged as public, private, or shared. In contrast to those of the other packages, which require users to switch constantly between system and personal phone books, LanFax Redirector's phone-book structure is a real boon.

Users also share access to libraries—collections of pre-imaged faxes that are sent repeatedly (e.g., price lists); skipping the imaging process makes these faxes quickly. However, LanFax Redirector's PCL (printer control language)-imaging engine is fast enough that you'll hardly notice the difference anyway.

Alcom's software bundle includes DOS and Windows clients. Both require a redirection TSR program. The DOS utilities include a print-capture TSR and the menu-driven Fax Manager. Fax Manager can be used to transmit PCX, ASCII, and fax files; view user status; and receive documents.

Windows utilities include a fax printer driver and a nice, Borland-style messaging system for managing fax documents. If you're a Windows user, you can easily select cover-page logos and attachment files. However, as with all CAS-based packages, you aren't free to rearrange the position of address and logo information on the cover page. The Windows printer driver includes a handy Hold feature that lets you tack documents from multiple applications onto a single fax. If you need to fax a spreadsheet and a letter, you just choose Hold after printing from Excel, print to the same driver from WordPerfect for Windows, and then release the fax.

If you require E-mail integration, you can get it through an optional MHS (Message Handling Service) gateway ($3595), which we didn't test. The bundle we did test lists at $2995 (without hardware) for a 50-user system.
**Advanced EZ-Fax for Networks 3.53**

Calculus's Advanced EZ-Fax comes closer to the model of an actual shared fax machine than any of the other servers. Like real fax machines, it includes built-in scanner support for sending paper documents and doesn't require a dedicated PC to service fax requests. But on the downside, EZ-Fax also lacks security features, easily configured cover pages, and E-mail integration. EZ-Fax includes a fax-modem/scanner card and server software, as well as Windows and DOS client utilities, for $1799 for a 10- or 50-user system.

EZ-Fax for Networks bundles a fax-modem card (with scanner support) and network software in an easy-to-use package.

The EZ-Fax server is a non-dedicated machine that runs a background process that requires 166 KB of conventional memory (considerably less with EMS). One user can continue to use the EZ-Fax server for other tasks, but the background process will occasionally take over the machine for file conversion. In practice, we found that the fax-server machine probably shouldn't be used for much more than light word processing.

Client software has print-redirection utilities and menu-driven DOS and Windows programs. When you launch a print job with an EZ-Fax print-capture utility installed, you can choose between faxing and printing; thus, you can leave the redirectors installed at all times and don't have to bother installing or uninstalling them.

With the Calculus Windows Fax Manager, you can view both transmit and receive logs or maintain phone books (each user can have multiple phone books). However, you can't simply fax a file from within the Windows fax manager. Calculus licenses the manager from Alien Computing, so if you know Faxit, you'll find it familiar going.

EZ-Fax makes heavy use of tags in text files for embedding graphics. You can define cover sheets with this method or attach preimagined files to local faxes.

**Faxserve 1.0**

One significant cost in building a network fax solution is the price of dedicating a high-powered workstation to the task of sending and receiving faxes. If you run a NetWare LAN, Cheyenne's NLM (NetWare loadable module)-based Faxserve provides an attractive alternative.

Faxserve is the first (and so far the only) network fax server built as a collection of NetWare NLMs. With Faxserve, you install the fax-modem card in the file server, eliminating the need for extra hardware.

As expected, NLM-based Faxserve's NetWare integration is very good. Client tools, shown here, provide a familiar NetWare-like C-Worthy interface to the fax server.

Obviously, this exacts an additional processing toll on your file server; however, we didn't find that it added much of a strain on our test network. Since file servers are so often limited by I/O requirements rather than by CPU horsepower, we expect our experience will be typical among Faxserve users.

Faxserver works with CAS applications using shared directories. Faxserve can also route faxes through MHS with FAXMAIL-NLM, a second module bundled with the package. Faxserve sells for $995, including mail support and DOS and Windows clients. We ran Faxserve with an Intel Satisfaction Modem/200.

You install Faxserve from a client workstation and then load the NLMs on the file server. Installation is easy and includes copying DOS and Windows client software to the network. Installing Faxserve generates a new NetWare user, named faxserve, on the server you select, which the Faxserve NLM uses for access to print queues and other NetWare services.

Naturally, Faxserve's integration with NetWare is tight. When you bring up Faxserve for the first time, you can pull users out of the NetWare directory into Faxserve's user list, configuring users as either administrators or users. It's worth stressing that Faxserve's user list is distinct from NetWare's, and you are required to maintain user lists for both entities.

By default, Faxserve uses NetWare's Mail directory structure for storing custom user files. This includes (CAS format) user phone books and custom cover-sheet logos. Faxserve DOS clients can switch between phone books, so we arranged for Faxserve clients to have access to both a central phone book and custom user versions. Windows clients maintain their own phone books in non-CAS format. The method for switching Windows phone books is clumsy—users need to change phone books in a configuration menu that's unrelated to sending and receiving.
Gain speed in your problem solving and confidence in your answers with Maple V...

Maple, developed at the University of Waterloo, is today's most complete symbolic math package, and it's now available from MathSoft, the makers of Mathcad. Maple's comprehensive library of over 2,000 built-in functions and easy-to-use interactive math package, and it's now available from 3-D Tube Plot created with Maple V.

The symbolic math software for engineering, science, and education professionals.

Maple is ideal for a wide range of design, VLSI design, chemistry, satellite calculations, so you can request an infinite variety of computations and graph your output in two or three dimensions.

Provides power and flexibility. You won't believe that something so powerful runs on everything from supercomputers to computers as little as 1MB of memory. And Maple's flexibility makes it easy to share files across all platforms. It's completely programmable... and Maple's user interface supports natural mathematical calculations, so you can request an infinite variety of computations and graph your output in two or three dimensions.

Use for a wide range of applications. Maple is ideal for a wide range of applications, including helicopter blade design, VLSI design, chemistry, satellite guidance systems, econometrics, electrical engineering, and applied mathematics — to name just a few. Maple frees you from the "bookkeeping" of complex calculations and lets you concentrate on modeling and problem solving.

Faxability, Intel's Windows client, provides a nice MDI that's easy to get around in. We tested Net Satisfaction with Intel's Satisfaction Modem/200 in the server.

Faxability, Intel's Windows client, provides a nice MDI that's easy to get around in. We tested Net Satisfaction with Intel's Satisfaction Modem/200 in the server.

Net Satisfaction Software 2.0 and Satisfaction Modem/200

Intel's Net Satisfaction is similar in architecture to Alcom's LanFax Redirector. Net Satisfaction is a CAS redirector that funnels client CAS service requests to a dedicated CAS-based server. However, Net Satisfaction supports only IPX/SPX as a transport, so it's limited to NetWare LANs. Net Satisfaction supports, but does not include, any Satisfaction modem; the software sells for $1995, including clients. The Satisfaction Modem/200 costs $369.

Net Satisfaction relies on NetWare for its transport, so it can afford some reliance on NetWare user information. Like most other packages, Net Satisfaction maintains its own user list, but you can pull users directly out of the NetWare bindery into Net Satisfaction. However, you will need to manually set some user access rights and set up the system log-in script to personalize each user's installation. In Net Satisfaction, users can have normal privileges or be designated as administrators or supervisors. As with LanFax Redirector, administrators can view first pages and route faxes. Supervisors can configure accounts.

Net Satisfaction includes DOS and Windows client software. Both clients require that users run a CAS redirection TSR. DOS clients can then choose between a print-capture TSR, a menu-based send/receive and status-inquiry program, and administrative utilities. Using the DOS TSRs is straightforward.

Both Windows and DOS clients of Net Satisfaction use CAS-format phone books, and users can easily switch among them. Again, we found the best way to work with this architecture was to create a shared company phone book and individual phone books for each user. Users can also tailor cover sheets and easily choose the cover-page logo.

One of the nicest features of Net Satisfaction is that it includes Intel's Faxability for Windows as its Windows client module. Faxability features the best user interface among Windows clients we have seen. It is simple to navigate and has toolbar icons that are refreshingly obvious. Faxability has MDI (Multiple Document Interface) windows (with cute icons) for the inbound fax log, outbound fax log, and user telephone book. In addition, faxability is the easiest and most usable package when it comes to customizing the cover page. Between these features and the toolbar, Faxability beats the other Windows fax clients hands-down. Faxability also includes a CAS-based printer driver for printing from within applications.
NetFax 4.01

E-mail, an option for many of these packages, provides the foundation for OAZ Communications' NetFax. NetFax uses Novell's MHS as a transport between fax-client stations and a dedicated server, which forms a gateway between MHS mail and fax. NetFax includes server software, a proprietary fax-modem board, and DOS and Windows clients for $2490. A NetWare network running MHS is required.

NetFax works by creating an MHS user ID for the fax server. Once this is in place, users mail fax messages to the fax server, and the fax server mails received faxes back to users.

Once we got NetFax installed, we found it robust and relatively easy to use from a client perspective. However, installing the package was a nightmare. Even though it comes with an automatic installation script, changing a default parameter (i.e., the MHS user name for the server) caused the script to update the name in some parts of the program but not in others, and it wouldn't work properly. We went through the installation process several times.

Authorized NetFax users are a subset of the users with MHS addresses. At installation time, you can pull NetFax user information out of the NetWare bindery, and the utility also builds the MHS directory structure from user names in the bindery. There are no separate NetFax privilege levels, and this sidesteps most management issues. However, if you want fax security, you'll need to assign NetWare permissions manually to the incoming message directory.

If you have an MHS-compatible mail system, you can use it to mail fax messages to the mail server. Faxes are always sent as cover letters, with additional sheets and documents sent as attachments. You specify phone numbers and other fax-specific information as part of the address line, or you can embed this information with command tags. Mail users receive faxes through MHS and can use NetFax client software to view and print faxes. If you aren't running an MHS-compatible mail system, NetFax includes a basic mail package as part of its DOS client software.

The DOS client software also includes a print-capture utility. If you use a third-party mail system as a transport, however, you can't fax directly from within applications; you'll need to capture printer output to a file before using the mail system to mail it (unless the mail system itself supports print capture). DOS users share a systemwide phone book (to which each user can add private entries) and a systemwide logo file.

The OAZ Windows client component also works through MHS, and it includes print capture and a stand-alone utility. Both of these hook into the mail-monitoring program via DDE; the monitoring program alerts you to fax events with a blinking icon. Windows phone-book information is kept in a local card file, which provides a nice interface, but this design isolates the Windows phone book from the system phone book provided by the NetFax server.

For inbound faxes, NetFax supports DTMF routing in the standard package. If you don't use DTMF, an administrative user can route faxes via mail from a central directory.

Facsys 3.30a

Unlike many of these packages, which come with enough disks and documentation to make a C compiler feel at home, software-only Facsys from Optus Software comes on a single disk accompanied by a pocket-size manual. The documentation is spotty in places, but Facsys itself is among the most robust, full-featured fax servers in this review.

Facsys consists of a dedicated server that communicates via NetWare protocols, shared directories, and NetWare print queues with fax-client nodes on the network. Facsys is not CAS-specific; in addition to Intel's Satisfaction board, Facsys supports the GammaFax board and a few others. However, Optus provides redirection shells (which we didn't test) for supporting CAS and FaxBIOS client applications. Facsys also includes MHS-gateway services for working with E-mail packages. The bundle costs $995.

Installing Facsys was simple. The installation program creates a NetWare print queue and sets the fax server as the NetWare print server. In effect, the Facsys print queue (PRINTQ_FAX) acts as a direct "fax queue." In addition, the installer creates NetWare groups FAX_ADMIN and FAX_ROUTER, which correspond to Facsys privilege levels. As the NetWare administrator, you simply need to configure a print job for the print queue.

Facsys includes several unique features, including an OCR routing capability that lets you route incoming faxes based on a numeric ID on the cover page.

Facsys includes several unique features, including an OCR routing capability that lets you route incoming faxes based on a numeric ID on the cover page.

Facsys provides the best NetWare integration of any of these packages. NetWare users are Facsys users; there is no separate name space to keep track of. By default, the NetWare group EVERYONE has access to Facsys services. To set Facsys privilege levels, you add users to the
Attention
U.S. BYTE Subscribers

Watch for the next BYTE DECK mailing that will be arriving in your mailbox soon!

Use this as a fast, convenient tool to purchase computer products and services. It’s loaded with essential hardware and software products that you should be aware of when making your buying decisions...and it’s absolutely FREE!

If you have a computer product or service, and would like to reach 275,000 influential BYTE magazine subscribers, please give Brad Dixon a call today at (603) 924-2596.

Here’s what a BYTE Deck advertiser has to say:

"The BYTE Deck consistently performs for us, that’s why we’ve been an advertiser for over two years!"

Karen Tacy, Marketing Manager
Rainbow Technologies, Irvine, CA

FAX SERVERS

FAX_ADMIN and FAX_ROUTER NetWare groups.

There is a downside to this NetWare dependency. First, you must give fax access to the group EVERYONE on a server. Also, there is a one-to-one correspondence between file-server users and fax-server users, so shops with more file servers than fax servers will require some work-arounds to provide access for each user.

Facsys provides Windows and DOS clients (which look and work very much alike), print-redirection services, and command-line utilities. Cover-page customization is a little inflexible; while you can install different default logos, you can’t choose a logo for each fax.

You can switch the print redirectors between PRINTQ_FAX and local or other queued printers on the fly (as you can with the printer drivers that Calculus provides)—this means that you can leave the redirectors installed at all times and don’t have to bother installing or uninstalling them. Users can also print directly to PRINTQ_FAX using PCL escape sequences for embedding phone numbers and other fax-specific information.

Incoming faxes can be manually routed, or you can use Facsys’s OCR routing capability. The OCR engine scans the first page of each inbound document for a numeric string. We have seen it work; however, OCR is still a little too finicky for us to recommend using it on a regular basis.

PureFax is a Windows network fax server; both client- and server-software modules are Windows-hosted. The fax modem (included in the package) can run in a dedicated or a nondedicated server.

PureFax 3.1

Pure Data’s PureFax is a pure Windows solution to the problem of faxing on PC LANs. Both PureFax’s client software and its dedicated server program are Windows applications. They communicate with one another via a shared-directory structure, so PureFax will work on most any LAN operating system.

PureFax comes with its own fax modem, a Pure Data PDI9614 CAS-compatible board. The fax modem includes support for data, as well as fax transmission. Modem and software costs just $699, which makes it a real bargain compared to the other fax servers.

The server software consists of two modules: Faxres (a board-driver TSR) and Faxsuper (the main server and administrative Windows application). Faxsuper lets you define system parameters and user information. Faxsuper is well designed for use with NetWare, and you can put user information from the NetWare bindery into the PureFax user list.

Each PureFax user gets his or her own directory. The directory holds directed faxes, as well as user phone books and logos. As with other CAS-based products, you can switch between phone books at will.

PureFax users all share a common privilege level. There are no administrator- or router-class users. Instead, PureFax designates the user of the system console (i.e., Faxsuper, the application running on the server) as the administrative user. The Faxsuper user can configure the system (with the proper password) or view the first page of any document and route it to the appropriate user. Alternatively, you can have PureFax print every incoming fax or route every fax to a single user.

The ability to route faxes extends to anyone with access to Faxsuper. However, you can modify the system configuration only by getting into Faxsuper’s password-protected Supervisor mode.

Windows clients can run a Windows application or print through a Windows printer driver. The Windows application provides a nice user interface, and we discovered sending and receiving faxes to be straightforward with PureFax.

continued
"Sure, I remember my first modem..."

"My first modem? It was a cheap thrill. And that impulsiveness really cost me. Now I know better. The DataPort 14.4 Data/Fax Modem gives me real value; even puts money in my pocket!"

Now I Know Better:

THE NEW AT&T DATAPORT™
14.4/FAX MODEM

Introducing the powerful, robust V.32bis DataPort 14.4/Fax Modem. It pays for itself by significantly reducing your long distance costs—and features fax capability, too! For IBM PC/AT/XT and Macintosh, it:

- Sends/receives text, data, and images
- Links PCs to PCs, fax machines, and mainframes anywhere in the world
- Transfers data files; exchanges images with fax machines
- Accesses E-mail, bulletin boards, and information services

THRILLING, AND PAYS FOR ITSELF

It's all in the technique. The DataPort 14.4/Fax Modem features AT&T's exclusive, new Optical phone Line Interface (OLI), pat. pending; and V.42bis data compression and error correction. It excels in performance, especially on extremely weak "real world" lines!

This faster transmission, with effective throughput of up to 57,600 bps, significantly reduces your long distance costs. And it improves your productivity—no more waiting for your screen to refresh; no standing in line to send faxes.

YOU INHERIT AT&T VALUE

Designed by AT&T Bell Labs and AT&T Paradyne with built-in reliability and the industry's widest compatibility—tested and proven. And only AT&T gives you a lifetime warranty and toll-free technical support for as long as you own your DataPort family product!

READY TO GET SERIOUS?

From just $415 suggested retail! 5 models to meet your exact needs for price, speed, features, and functions: the DataPort 14.4/Fax Modem and DataPort 9.6/Fax Modem, in standalone and PC-internal card models; and the DataPort 14.4 Modem standalone.

Proudly made by AT&T Paradyne in the U.S.A.

For more information on the DataPort family or the name of the dealer nearest you—call us at 1 800 554-4996 ext. 96.

SOLIDLY-BUILT, SOLIDLY-BACKED BY AT&T

Circle 158 on Inquiry Card (RESELLERS: 159).
Fax Servers for Macs

4Sight 2.0.3

This is industrial-strength faxing for the Macintosh. Circuit Research's 4Sight, a $2749 package (for 50 users), simplifies the administration and tracking of large numbers of users with high-volume fax requirements. 4Sight supports multiple servers within a network and multiple fax modems per server. Individual fax lines can be dedicated for incoming or urgent-only faxes. 4Sight's server communicates with its clients through E-mail — either through the built-in 4-Link or through Microsoft Mail or CE QuickMail. This removes the need to have an AppleShare server on the network for exchanging files. In addition, the fax server does not need to be a dedicated machine. When an application creates a fax, the client printer driver spools an intermediary-format file to disk and launches the 4-Link DA (desk accessory). (You can also use the 4-Link DA for composing stand-alone faxes.) At this point, you've constructed a mailable package that has a single enclosure (the document you just printed). To this, you add a cover sheet with the destination and possibly more documents (e.g., previously built fax images, text files, and PICT images). You can preview any of these file formats. This package is mailed to the server, which images the cover sheet and transmits the data into final fax format. Although this procedure returns control to the client workstation quickly, the fax itself can take a while to begin transmitting. Most of the packages we tested took 2 or 3 minutes to begin transmitting a complex Word document; 4Sight took over 6 minutes.

4Sight gives you complete control over cover-page layout. You can specify the size and location of the logo and any text field. 4Sight has its own list of authorized users, but the administrator can let 4Sight automatically add each LAN client the first time he or she attempts a fax transmission. Phone books are stored as tab-delimited files that can be easily manipulated by other programs.

Administrators can choose to select a new folder every day, week, or month, into which all archived faxes and logs are stored. This greatly simplifies administration of accounting and off-site archiving.

One minor drawback to 4Sight is its reliance on a particular modem in each of the countries it's sold in. The parent publisher, U.K.-based 4Sight, certifies a fax modem in each country. In the U.S., the modem is the FlexFax from Circuit Research. Circuit Research sells the bundle we tested. Among the features of the FlexFax modem is a large on-board buffer that can improve server throughput when controlling several modems.

Overall, 4Sight blends the strength of a GUI with the industrial guts required for a high-volume faxing environment. If you've got high-volume requirements on a Mac, get 4Sight.

Faxstf Net 2.2.3

TF Technologies' Faxstf Net, a shared-file fax server, requires an AppleShare server for client/fax-server communication. You can run Faxstf on a nondedicated Mac, but STF recommends dedicating a server for heavy loads. The low-cost package ($249) provides fax services to all users (up to the limit of your AppleShare server) within a single network zone. Additional licenses are required for each zone in your organization.

The user interface is simple and intuitive. Although not as flexible as 4Sight, Faxstf lets you design cover pages quickly by pasting graphics into a template image. You copy a graphics image from a paint or draw program and paste it into a new or existing cover-page template. Text on the cover page is represented by a gray box that you can drag around for proper positioning.

You choose destinations by dragging names from the phone book into a destination box. In addition, you can send short notes of up to 255 characters using the Quickfax DA.

A printer driver redirects the output from any application to the fax server. You can choose the fax printer driver permanently from the standard Mac Chooser or temporarily through a user-configurable hot-key sequence. The hot key turns the normal Print and Printer Setup entries in the File menu into Fax and Fax Setup. If any other program (e.g., terminal emulation) tries to get hold of the serial port while Faxstf has control, the fax package relinquishes control until the other program terminates.

We found this printer-driver interface the best of any of the packages we tested.

Shared files on the AppleShare server provide communication between users and
Have You Ever Wanted To Leap Out The Nearest Window?

Take The Plunge With Proxy. It's Network Remote Control For Windows, From Windows.

Some things you expect in remote control software. Like lightning-fast speed. And control over both DOS and Windows on the host PC. But new Proxy gives you something you probably don’t expect. Because it not only works with Windows, it works from Windows. And that makes all the difference.

Proxy supports host computers running Windows.

You can connect to multiple PCs over a network, with each appearing in its own window.

Run time-consuming jobs on dedicated processors, and control them all from Proxy.

You see other remote control products run from DOS, even those that support a host running Windows. So they allow just one connection at a time, and demand total attention from your computer. But Proxy is a Windows application that lets you make multiple connections simultaneously. You can display and control a different host PC in each window you open, while you continue to run local applications.

Users Calling For Help? Leap Out The Nearest Window.

If your job is to help users on the network, Proxy will make it easier.

No need to abandon your own work when someone calls. Just click on a Proxy icon and instantly connect to the caller’s machine. You now have full control of their hardware and software, complete with mouse and keyboard support, whether they’re running Windows or DOS.

Reconfiguring Lots of Workstations? Leap Out The Nearest Window.

Now you can perform administrative chores like software installation, updates, and system configuration without going from room to room. Just capture a PC and perform any operation as if you were sitting in front of it. You can even reboot it remotely!


Imagine off-loading your most CPU-intensive tasks to separate machines you control as if they were part of your own desktop. Imagine two, three, or more applications, each running at full speed because each has its own dedicated processor. That’s the power of multi-processing with Proxy.

You can make Proxy available across the network and give power-hungry users access to spare or idle PCs. You can even dedicate PCs to specific tasks, like a high-powered 486 for CAD or a modem-equipped 286 for communications.

Take The Next Logical Leap in Remote Control.

Get the most advanced network remote control available, with applications ranging from user support to multi-processing. Get Proxy. It’s from Funk Software. The same people who brought you Sideways™, Allways, and other top-selling PC utilities.

Call today to order or for more information.

1-800-828-4146 Ext. 802 (U.S. and Canada)

Proxy gives you complete control of any computer on the network.

FUNK SOFTWARE

System Requirements: Proxy “Master” runs in Windows and can control multiple “Hosts” running DOS or Windows over an IPX network (e.g., NetWare).

© 1992 Funk Software, Inc. Proxy is a trademark of Funk Software, Inc.

Funk Software, 222 Third Street, Cambridge, MA 02142  Tel (617) 497-6339  Fax (617) 547-1031

Circle 160 on Inquiry Card (RESELLERS: 161).
the fax server. Each client workstation images the document and deposits an assigned folder for it on the file server. The fax-server software periodically scans all the folders in search of unsent faxes. The client workstation images the fax body but leaves the imaging of the cover page to the server. This ensures that date and time stamps are based on transmission time, not on when the fax request entered the queue.

You can make Faxsf as unobtrusive or intrusive as you like. The default option is notifying you when a fax either is transmitted successfully or fails, but you can choose to be notified for different conditions.

Fax transmissions can notify you as soon as they are completed, or you can choose to check the activity log periodically to see if the transmission was successful. Client workstations maintain individual activity logs. Even though you can print these logs and export them to a variety of word processing formats, they can’t be exported to any format importable by a spreadsheet or database. This makes integration with an automated accounting and analysis application difficult.

Faxsf receives incoming faxes; however, it does away with any routing problems by making all incoming faxes available to all users. This can cause serious problems for large organizations.

Fax Servers for Unix

IsoFax provides an Open Look client interface that lets you configure all the usual sending parameters, including delayed transmission. It also runs in terminal and command-line environments.

IsoFax 5.1

The Bristol Group’s Isofax goes beyond most fax packages in its document management support. Besides the basic fax transmission and reception, IsoFax provides OCR on incoming documents and a searchable document management front end that lets you locate faxes based on user-entered keys, such as subject, date, recipient, and keywords. You can’t search the cover-page quick message area, although this would make a good addition. You can search phone books by keywords.

IsoFax can run in three environments: command-line (scriptable), VT100 terminal (text-only screen), and Sun Open Look. This flexibility ensures that even remote users have the ability to compose and transmit fax messages.

All Bristol’s documentation is geared toward Sun workstations, resulting in a trouble-free, step-by-step installation. We had the system operational within half an hour of inserting the tape cartridge. Licensing is based on a floating-network license, simplifying administration. A 50-user system costs $3490.

You can compose faxes from a separate Faxtool application or fax directly from any X Window System application. Direct faxing requires that you select the xfax queue as your printer. When you print, a window appears that lets you select recipients and a cover letter.

Faxtool’s fax composition method is the same in each environment. You select a sequence of files, consisting of cover page, text, PostScript, and Sun raster data, to be gathered into a single fax. You then select the fax’s destination—either single or multiple recipients—and create a fax image that is transmitted to the server. ASCII files may be imaged either at screen-raster quality or by converting to PostScript fonts. Although slower, PostScript produces a somewhat higher-quality output. To save time with frequently faxed information, you can also include preimaged files.

Cover sheets may be either ASCII or PostScript source files. In either case, you define data fields, such as To, From, and Subject, through ASCII escape sequences. IsoFax does not provide any sort of interactive cover-page design utility.

Since you’re assigned a separate fax directory, the operating system provides the security. Additional security is available by entering a key to scramble transmitted and received fax images.

Replix 1.0

Replix is Samsung’s first foray into the world of Unix business software—and it’s an excellent first effort. The terms well-crafted and easy to use paint an accurate picture. From the excellent documentation to the simple and obvious interface, this product is designed for ease of use. Yet behind this surface simplicity is a powerful engine we wish wasn’t restricted to the Unix platform.

The icon bar is the pivot point that Replix revolves around. Administrators and users share a common set of tools in the toolbar, but administrators have access to an additional administration icon.

Replix can transmit faxes from a command-line or X Window System interface, or directly from third-party applications that produce ASCII or PostScript output through print capture. The X interface includes a simple text editor for quickly composing short faxes.

The stand-alone Replix application is a well-integrated, multiple-window interface that gives you access to all Replix functions. The fax administrator works within the same interface with an additional administration icon.

You can build faxes from ASCII, PostScript, and various bit-map format files. Once your fax is composed, you can view
Above And Beyond Basic.

INTRODUCING THE EASIEST BASIC DEVELOPMENT SYSTEM FOR WINDOWS.

Compared to Visual BASIC, CA-REALIZER® is half the cost and twice the product.

Develop applications using the familiar procedural language model and a large array of powerful tools. You don't need to learn all kinds of confusing new techniques. Just type in programs or design them visually with FormDev. It's an interactive WYSIWYG, point and click tool that generates code. With a single command you can add Programmable Application Tools like spreadsheets, charts, text editors, animation, graphics tablets and user-friendly forms. And CA-REALIZER offers many features other BASICS don't, like automatic array processing.

Arrays are re-dimensioned and processed automatically. Algorithms can be written as formulae instead of complex looped expressions.

Once an application is complete, you can compile it into a stand-alone Windows application and distribute it royalty-free with the runtime module that's included. And you can generate an installation disk with the push of a button.

PC Computing said, "No other Windows BASIC can match it for power and breadth of features.'

And at $99, they can't match the price either.

So call 1-800 CALL CAI today for more information and the name of your nearest dealer.

Don't waste another day trying to figure out Visual BASIC. Leave that for your competition.

CA-Realizer


Unfortunately, no single fax server will serve every network environment.

It and rearrange pages at will. Cover pages consist of PostScript files that contain ASCII escape sequences indicating key data fields such as To, From, and Subject. Cover sheets can include an optional signature graphic, which you can choose to include at send time.

In Replix, each fax has an owner. Even multiple users with the same name on different clients are differentiated. All outgoing faxes are stored in the same directory. However, individual users can see the status only of the faxes they own. Fax administrators (there can be several) can see and manipulate all faxes. Both users and administrators can run queries against the fax list specifying keys such as date, time, user, or recipient.

Incoming faxes are also stored in a single directory. Once faxes are received, a fax administrator must route the fax to the proper destination. This is done in one of several ways. The administrator can simply change the ownership of the fax, so the addressee will see it when next checking the fax status. Or Replix can send an E-mail message indicating that a fax has arrived. Alternatively, you can send the entire fax via E-mail.

Replix contains a set of hooks that allow integration of custom applications. Events such as a send or retrieve request, phone-line access, or fax reception act as triggers. A simple example of a custom application would be to send E-mail to a particular fax administrator noting the time of day whenever a new fax was received. At $6713 for a 50-user license, Replix is rather expensive. It is, however, powerful, capable, and—most surprising—easy to use, even for nontechnical users.

Fax Populi
Obviously, the fax-server market is filled with capable packages. Unfortunately, no single fax server will serve every network environment, and the most powerful packages don't have the best client interfaces. And as we mentioned earlier, none of these packages supports mixed DOS/Windows, Macintosh, and Unix clients.

We ended up choosing our favorite packages on a variety of criteria—some for strong client support, and some for scalability and ease of administration. However, each of the packages we chose was at least among the easiest to use on its platform.

For NetWare networks, you can make a very good selection from among Alcom's LanFax Redirector, Intel's Net Satisfaction, Cheyenne's Fax-serve, or Optus' Facsys. For PCs running on non-NetWare LANs, LanFax Redirector is the best choice, although Pure Data's PureFax makes a good economical server.

Of the Mac packages, Circuit Research's 4Sight is the more capable package in large organizations, even though we preferred the interface STF Technologies' Faxstf provides. Finally, despite its newcomer status, Samsung's Replix is the best package we have seen for Unix networks.

ACKNOWLEDGMENT
The authors would like to thank Pete Davidson of Davidson Consulting (Burbank, CA) for his contribution to the background research for this article.

Raymond GA Côté and Stan Wszola are testing editors for the BYTE Lab. Steve Apiki is a BYTE Lab technical editor. You can reach them on BIX as "rgacote," "stan," and "apiki," or on the Internet at rgacote@bytepb.com, stan@bytepb.com, and apiki@bytepb.com, respectively.

COMPANY INFORMATION

Alcom Corp.
(LanFax Redirector 2.1)
1616 North Shoreline Blvd.
Mountain View, CA 94043
(415) 694-7000
fax: (415) 694-7070
Circle 987 on Inquiry Card.

The Bristol Group, Ltd.
(IsoFax 5.1)
100 Larkspur Landing Cir.,
Suite 200
Larkspur, CA 94939
(415) 925-9250
fax: (415) 925-9278
Circle 988 on Inquiry Card.

Calculus, Inc.
(Advanced EZ-Fax for Networks 3.33)
1761 West Hillsboro Blvd.
Deerfield Beach, FL 33442
(305) 481-2334
fax: (305) 481-1866
Circle 989 on Inquiry Card.

Cheyenne Software, Inc.
(Faxserve 1.0)
55 Bryant Ave.
Roslyn, NY 11576
(800) 243-9462
fax: (516) 484-5110
Circle 990 on Inquiry Card.

Circuit Research Corp.
(4Sight Fax 2.0.3)
2 Townsend W, Suite 6
Nashua, NH 03062
(603) 880-4000
fax: (603) 880-8297
Circle 991 on Inquiry Card.

Intel Corp.
(NetSatisfaction Software 2.0, Satisfaction Modem/200)
5200 Northeast Elam Young Pkwy.
Hillsboro, OR 97124
(800) 538-3373
Circle 992 on Inquiry Card.

OAZ Communications
(FaxNet 4.01)
44920 Osgood Rd.
Fremont, CA 94539
(800) 638-3293
(510) 226-0171
Circle 993 on Inquiry Card.

Optus Software, Inc.
(Facsys 3.30a)
100 Davidson Ave.
Somerset, NJ 08873
(908) 271-9568
fax: (908) 271-9572
Circle 994 on Inquiry Card.

Pure Data, Inc.
(PureFax 3.1)
1740 South I-35
Carrollton, TX 75006
(214) 242-2040
fax: (214) 242-9487
Circle 995 on Inquiry Card.

OAZ Communications
(LanFax Redirector 2.1)
1616 North Shoreline Blvd.
Mountain View, CA 94043
(415) 694-7000
fax: (415) 694-7070
Circle 987 on Inquiry Card.

OPTs, Inc.
(4Sight Fax 2.0.3)
2 Townsend W, Suite 6
Nashua, NH 03063
(603) 880-4000
fax: (603) 880-8297
Circle 991 on Inquiry Card.

Pure Data, Inc.
(PureFax 3.1)
1740 South I-35
Carrollton, TX 75006
(214) 242-2040
fax: (214) 242-9487
Circle 995 on Inquiry Card.

STF Technologies, Inc.
(FaxNet 2.2.3)
Jct. I-70 & Hwy. 23
P.O. Box 81
Concordia, MO 64020
(816) 463-2021
fax: (816) 463-7958
Circle 996 on Inquiry Card.

Samsung Software America
(Replix 1.0)
1 Corporate Dr.
Andover, MA 01810
(800) 899-7724
(508) 685-7200
fax: (508) 685-4940
Circle 997 on Inquiry Card.

Circle 998 on Inquiry Card.
Get 3 Books for only $4.95
plus 1 book FREE upon prepayment
when you join the Computer Professionals' Book Society

YES! Rush me the following titles, billing me just $4.95 (plus shipping/handling & sales tax). Enroll me as a member of the Computer Professionals' Book Society according to the terms outlined in this ad. If not satisfied, I may return the books within 10 days for a full refund and my membership will be cancelled. I agree to purchase just 3 more selections at regular Society prices during the next 2 years and may resign anytime thereafter.

Code #’s of my books for $4.95

If you select a book that counts as 2 choices, write the book number in one box and XX in the next.

☐ Bill me (FREE book not available with this payment option.)

SPECIAL OFFER! Prepay your order by check, money order, or credit card and receive a 4th book of your choice FREE.

☐ YES! I want the FREE BOOK indicated below. My introductory payment of $4.95 plus $4.95 Code # of shipping/handling & applicable sales tax is enclosed.

☐ Check or money order enclosed made payable to: McGraw-Hill, Inc.

☐ Please charge my: ☐ VISA ☐ MasterCard ☐ Amer. Exp.

Acct. No. ___________________________ Exp. Date __________

Signature ____________________________ (required on all credit card orders)

Name ________________________________

Address/Apt. # _________________________

City __________________________________ State __________ Zip Phone __________

Offer valid for new members only, subject to acceptance by CPBS. U.S. orders are shipped 4th Class Book Post. Canada must remit in U.S. funds drawn on U.S. banks. Canadian orders are shipped International Book Post—add $9.25 shipping/handling. Applicants outside the U.S. and Canada will receive special ordering instructions. A shipping/handling charge & sales tax will be added to all orders © 1993 CPBS
As a member of the Computer Professionals' Book Society...

...you'll enjoy receiving Society bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off of regular publishers' prices. If you want the Main Selection do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide and if you ever receive a book you don't want, due to late mail delivery of the News, you can return it at our expense. And you'll be eligible for FREE BOOKS through the NEW Bonus Book Program. Your only obligation is to purchase 3 more books during the next 2 years, after which you may cancel your membership at any time.
New Tricks for Slow Macs

RICK GREHAN

If your love affair with the Macintosh has cooled because your 68000- or 68020-based machine doesn’t run today’s software or does so in a painfully slow manner, a Mac accelerator board may rekindle the flame. There are now dozens of accelerator boards on the market that can upgrade your system with 68030 and 68040 CPUs running at 25, 33, and even 50 MHz. In addition, these accelerator boards can provide math coprocessors for systems that never had them before. The result is a faster Mac that’s suitable for today’s applications for an upgrade cost of between $250 and $1700 (depending on the Mac model you have).

For this roundup, I evaluated 17 Mac accelerator boards designed for systems ranging from the new Performa 400 to the aged Mac 512K. All but one of the boards can be installed by end users (the exception is the Brainstorm, for the Mac Plus). In addition to the Brainstorm, I looked at products from Applied Engineering, DayStar Digital, Dove Computer, Extreme Systems, Fusion Data Systems, Harris Laboratories, Impulse Technology, MacProducts USA, Mobius Technologies, System Technology, and Total Systems.

Performance Indicators

When choosing a Mac accelerator board, you must make sure it has the right combination of performance and features for your applications. The text box “When to Upgrade” on page 202 describes the advantages of the 68030 and 68040 CPUs as well as the 68881 and 68882 floating-point processors. The table shows the benchmark results of each accelerator board running the BYTE Lab’s latest version of its Macintosh benchmarks (for more information on the benchmarks, see this month’s Reviewer’s Notebook). The table also shows pricing, compatibility, and other essential information about the boards.

As you examine the boards’ performance and features, consider what special requirements you may have. Do you need a number cruncher? If so, an accelerator board with a high FPU index should be your first pick. How about a large-screen monitor? One of the boards that come with a video adapter could be the best choice. Finally, compare the price you’d pay for an accelerator board to the cost of buying a new Mac. With the low prices of today’s Macs, you may find it’s more economical to trade in your 68000-based system for a newer model.

My Macintosh test-bed represented a good sampling of the available Mac models. I used a Mac Plus, SE, SE/30, LC II, IIci, and IIfi. The features table shows which accelerator boards support each Mac model. Most of the boards run in more than one Mac model either as is or with an adapter card.

Some manufacturers produce an entire line of accelerator boards, each targeted at a different Mac platform. One example is the DayStar PowerCache, which can plug directly into a IIci or a Performa 600. With an adapter card, the PowerCache will fit into a Classic, SE, SE/30, LC, LC II, IIx, IIcx, IIfi, or Performa 400. Quite a chameleon act.

Installation

Adding an accelerator board always starts with opening your Mac. In general, it is more difficult to upgrade a Plus, Classic, SE, or SE/30; this is due largely to their construction. Successfully popping open one of these Macs is right up there with shucking an oyster: It’s not easily done without the right tools.

Unhooking all the cables from the motherboard requires no small amount of contortions as you seek to avoid the stem of the CRT and the exposed components of the power supply (again, this is especially true for Pluses, Classics, and SE-class machines). Dangerous volatges are afoot, even for a period of time after you have unplugged the system. So, it’s important to remove metal watchbands, bracelets, rings—anything conductive that might inadvertently make you part of a circuit—before you begin. Plan on spending about an hour upgrading a Plus, Classic, or SE machine. And don’t forget to bring your torx, a case-cracking tool, and a couple of screwdrivers.

Getting into other Mac models is a cake-walk by comparison. You simply remove one screw on the back of the machine and pop off the top. On average, you can install an accelerator board in these models in...
about a half hour. Possible installation snags may arise. For example, if you install the Voyager 030 in a Mac II, you must detach the drive platform and pry the CPU and PMMU (paged memory management unit) chips from their sockets.

However, don’t let these apparent dangers keep you from considering the possibility of getting an upgrade. Many manufacturers offer free installation.

Board Configurations
Most of the accelerator boards I tested were 68030-based; a smaller number were 68040-based, while the Performer2 and the ever-unique Brainstorm used a 68000. All the 68030 boards were socketed to accept a 68881 or 68882 FPU, and all the units I tested had 68882 coprocessors installed. All the 68040 cards have no need for an FPU socket, because they use a version of the CPU with an integrated FPU. (The 68000-based Performer2 comes with a 68881 coprocessor.)

The Mobius accelerator boards for the SE and Classic, as well as the Vandal SE, RailgunPro 030, and (optionally) the Gemini Ultra for the SE, also include graphics adapters as part of the accelerator hardware. This lets you connect displays that are larger than 9 inches to Mac SEs and Classics.

Some accelerator boards, especially those for the Classic and SE, carry SIMM sockets for holding memory local to the board. This on-board memory keeps up with the faster processor without a lot of wait states. For example, the Gemini Ultra can take your SE from its ordinary maximum of 4 MB to a previously unheard-of 64 MB (ideal for memory-hungry graphics applications or a big RAM disk).

The Software Side
The installation software that comes with the boards usually uses a control panel design. For the 68030 boards, this control panel program consists of a simple dialog box with on/off switches that let you enable or disable the CPU’s instruction and data caches. As I’ll discuss later, this plays an important role in compatibility.

The 68040 boards’ control panel software typically allows you to select cache modes: copyback, write-through, or none. With the TokaMac boards, the control panel lets you choose only copyback or write-through modes. A cache running in copyback mode is fastest: Data written to the cache is written to main memory only when it’s absolutely necessary. Hence, the processor is less frequently burdened.
NEW TRICKS FOR SLOW MACS

MAC ACCELERATOR BOARD FEATURES AND BENCHMARKS

The benchmark results shown below are normalized to the performance of a 4-GB Mac SE/30; see text for further details. For installation difficulty, easy = you simply open the top of the machine and plug in the accelerator board; moderate = some cabling is necessary; hard = you must pull chips, perhaps do some soldering, and attach additional cables. (N/A = not applicable.)

<table>
<thead>
<tr>
<th>Systems available</th>
<th>Brainstorm</th>
<th>Gemini Ultra</th>
<th>Impact</th>
<th>Marathon Racer</th>
<th>Mobius</th>
<th>Performance/040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems tested</td>
<td>Plus, SE, 512K</td>
<td>LC, LC II</td>
<td>Classic, SE</td>
<td>SE, Classic</td>
<td>II, IIX, IIXx, IIXs, IIXf, IIXs</td>
<td>IIIX, IIXx, IIXs, IIXf, IIXs</td>
</tr>
<tr>
<td>Price</td>
<td>$249</td>
<td>$1018</td>
<td>$698</td>
<td>$599</td>
<td>$594 (SE): $644 (Classic)</td>
<td>$1750 (25 MHz): $2399 (33 MHz)</td>
</tr>
<tr>
<td>Processor</td>
<td>68000</td>
<td>68000</td>
<td>68030</td>
<td>68030</td>
<td>68030</td>
<td>68030</td>
</tr>
<tr>
<td>Processor speeds (MHz)</td>
<td>16</td>
<td>20, 33, 50</td>
<td>32</td>
<td>16</td>
<td>25</td>
<td>25, 33</td>
</tr>
<tr>
<td>External CPU cache</td>
<td>None</td>
<td>None</td>
<td>32K</td>
<td>32K</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Coprocessor</td>
<td>None</td>
<td>882</td>
<td>882</td>
<td>882</td>
<td>882</td>
<td>N/A</td>
</tr>
<tr>
<td>Maximum RAM</td>
<td>N/A</td>
<td>64 MB</td>
<td>None</td>
<td>16 MB</td>
<td>None</td>
<td>128 MB</td>
</tr>
<tr>
<td>Software</td>
<td>None</td>
<td>A, B, C</td>
<td>C</td>
<td>C</td>
<td>A, B, C</td>
<td>E</td>
</tr>
<tr>
<td>Video adapter available?</td>
<td>No</td>
<td>Optional</td>
<td>No</td>
<td>90-day replacement</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Warranty</td>
<td>1 year limited</td>
<td>1 year limited</td>
<td>1 year limited</td>
<td>90-day replacement</td>
<td>2 years</td>
<td>1 year limited</td>
</tr>
<tr>
<td>Installation difficulty</td>
<td>Hard</td>
<td>Moderate</td>
<td>Easy</td>
<td>Moderate</td>
<td>SE: moderate; Classic: hard</td>
<td>Easy</td>
</tr>
</tbody>
</table>

BENCHMARKS

CPU speed tested (MHz) | 16 | 50 | 32 | 16 | 25 | 33
CPU index | 0.5 | 2.1 | 1.3 | Classic: 0.8; SE: 0.7 | Classic: 1.3; SE: 1.3 | 2.6 |
FPU index | 0.3 | 10.3 | 5.7 | Classic: 1.8; SE: 1.8 | Classic: 4.3; SE: 3.8 | 14.5 |

Notes:
1. One or more benchmark applications could run only if some of the board's features were disabled (see text).
2. Mathcad failed to see the board's FPU.

RAM disk, it could be an ideal place to put things like temporary files that your application creates, the HyperCard Home stack, and so on.

To maximize performance, some accelerator boards copy ROM to the accelerator's RAM at start-up. You get a boost from this option because ROM has a longer access time than RAM. Moving the code to RAM means that the frequently executed Toolbox routines in ROM can be run from the faster RAM.

FPU Considerations

Many of the accelerator boards that come with FPUs offer software that patches the Mac's SANE (Standard Apple Numeric Environment) calls to provide faster floating-point operations. Some go beyond simply redirecting floating-point calls from SANE routines to the FPU itself. For example, the Transwarp CI board comes with software that implements what Applied Engineering calls '882 Express. When '882 Express is active, it bypasses routines in Apple's SANE package that check the results of the FPU for accuracy. When this accuracy checking is unnecessary (it apparently takes place only for some of the trigonometric functions), '882 Express should result in improved performance.

As good as caching and ROM-copying sound, they don't always work. Some software simply won't work with caching enabled. This is not a fault of the accelerator board; it's what happens when the board tries to run software written by programmers who weren't thinking ahead to these days of cached, high-speed 68xxx CPUs. For example, I was unable to run PageMaker 4.0 on the TokaMac boards with the cache in copy-back mode.

Most compatibility problems are linked to the CPU cache and occur frequently in programs that execute self-modifying code. (See this month's Reviewer's Notebook for more details.) Many accelerator board manufacturers provide a list of incompatible applications and, in some cases, tell you how to solve the problem.

Other manufacturers take a more active approach to solving incompatibilities.
NEW TRICKS FOR SLOW MACS

<table>
<thead>
<tr>
<th>Performer2</th>
<th>PowerCache</th>
<th>Quik30</th>
<th>RailgunPro 030</th>
<th>TokaMac</th>
<th>Transwarp Cl</th>
<th>Vandal SE</th>
<th>Voyager 030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic, SE</td>
<td>SE/30, LC,</td>
<td>SE</td>
<td>Classic</td>
<td>IICI, LC,</td>
<td>IICI</td>
<td>SE</td>
<td>II, IIX</td>
</tr>
<tr>
<td>SE</td>
<td>IICI</td>
<td>SE</td>
<td>SE/30, IIX</td>
<td>SE/30, IIX</td>
<td>SE/30</td>
<td>SE</td>
<td>II, IIX</td>
</tr>
<tr>
<td>$249</td>
<td>$1599</td>
<td>$795</td>
<td>$899 (SE)</td>
<td>$1695</td>
<td>$1265</td>
<td>$699</td>
<td>$1509</td>
</tr>
<tr>
<td>68000</td>
<td>68030</td>
<td>68030</td>
<td>68030</td>
<td>68040</td>
<td>68030</td>
<td>68030</td>
<td>68030</td>
</tr>
<tr>
<td>16</td>
<td>33, 40, 50</td>
<td>16, 25, 33</td>
<td>16, 25, 33</td>
<td>25</td>
<td>50</td>
<td>33, 50</td>
<td>33, 50</td>
</tr>
<tr>
<td>96K</td>
<td>32K</td>
<td>None</td>
<td>None</td>
<td>64K</td>
<td>None</td>
<td>64K</td>
<td>64K</td>
</tr>
<tr>
<td>881</td>
<td>882</td>
<td>881, 882</td>
<td>N/A</td>
<td>882</td>
<td>882</td>
<td>882</td>
<td>882</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>16 MB</td>
<td>16 MB</td>
<td>None</td>
<td>16 MB</td>
<td>8 MB</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>C</td>
<td>A, B</td>
<td>D</td>
<td>None</td>
<td>A, B, C</td>
<td>A, B, C</td>
<td></td>
</tr>
<tr>
<td>Soon ($149 extra)</td>
<td>No</td>
<td>No</td>
<td>Optional</td>
<td>No</td>
<td>Yes</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Lifetime</td>
<td>3 years</td>
<td>2 years</td>
<td>1 year</td>
<td>1 year (hardware)</td>
<td>1 year (hardware)</td>
<td>1 year (hardware)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>limited</td>
<td>parts/labor</td>
<td>parts/labor</td>
<td>1 year (hardware)</td>
<td>1 year (hardware)</td>
<td>1 year (hardware)</td>
<td></td>
</tr>
<tr>
<td>SE/30: moderate; II, IIX, IIX: hard; others: easy</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate (SE) to easy</td>
<td>Easy</td>
<td>Moderate</td>
<td>Hard</td>
<td></td>
</tr>
</tbody>
</table>

For example, the 68040-based TokaMac boards come with a program called Multipatch that searches an executable file for code that uses 68020/68030 cache-clearing instructions and replaces them with their 68040 equivalents. The Performance/040’s control panel lets you build a compatibility list. This is a list of software package names and an associated compatibility rating, which indicates which cache mode the software can run (copyback, writethrough, or none). When you launch a program, the Performance/040’s software checks the compatibility list and automatically sets the cache mode appropriately.

Often, however, you have to resort to experimentation. If your application blows up, you must turn off features one at a time until the program starts working again. Then when you’ve identified the feature that creates the problem, you reenable the other features one by one, verifying each time that the program still executes. This is a lot of work, but it’s worth it for applications that you use frequently.

It’s also possible that you’ll have to update your applications to run in accelerated mode. For example, to run Microsoft Word 4.0d on the Performance/040, you have to disable the cache. However, Word 5.0 will run on the Performance/040 with the cache enabled and in copyback mode.

If all else fails, you can always run your system in its unaccelerated mode. All the boards I tested (except for the Brainstorm) let you boot your system so that it appears to be operating with its original hardware. In most cases, you reboot the machine by pressing the reset and interrupt switches in a particular sequence. Since the Brainstorm actually alters components on your Mac Plus’s motherboard, a Brainstormed Mac Plus is forever accelerated.

Lab Tests

The BYTE Lab’s application and low-level benchmarks exercise all components of the system—graphics, CPU, FPU, and disk. I focused on those tests that would most likely indicate a system’s CPU and FPU power. Since I was testing the boards on a variety of systems with differing disk and graphics systems, it would be unreasonable to compare, for example, the database scores of one accelerator board to those of another.

I ran all tests under System 7.0.1. For systems that support a color monitor, I reduced the display depth to monochrome. For those accelerator boards that support on-board RAM, I ran them with 4 MB on the accelerator board (usually, this meant that I needed to have 4 MB on the system board). Otherwise, I ran them with 4 MB on the motherboard. (The exception was the Voyager 030, which ran with 8 MB in a Mac II.)

To derive a CPU index, I took the results from the BYTE Microsoft Word tests, PageMaker tests, Think C tests, and low-level CPU benchmarks. The index is simply the nonweighted average of the times normalized against the results taken for an unaccelerated SE 30. The FPU index is composed of results from the BYTE Mathcad tests, Excel tests, and low-level CPU benchmarks. I got the number using the same technique I used for the CPU index.
NEW TRICKS FOR SLOW MACS

When to Upgrade

Does having a faster CPU or FPU justify the time and expense of upgrading? Here’s a sketch of the benefits offered by the latest members of the 68000 family.

68030Essentially an integration of the 68020 CPU and the 68851 PMMU (paged memory management unit). The 68030 includes a 256-byte data cache as well as a 256-byte instruction cache. The 68030’s predecessor, the 68020, included only an instruction cache.

The primary advantage of the 68030 is that it’s faster than its predecessor due to caches and burst-read mode (used to rapidly fill the caches from main memory). The 68030’s integral MMU also lets you use virtual memory under System 7.0 or run A/UX (a 68020 CPU with a 68851 PMMU also accomplishes this, but the communications between the two chips adds overhead).

68040Integrates a 68030 with a 68881/68882-compatible FPU. In addition, the instruction cache is extended to 4 KB, and an independent 4-KB data cache is added. Internally, there are multiple independent execution pipelines, so the integer unit (the CPU), FPU, and MMU can be executing simultaneously.

As with the MMU on the 68030, moving the FPU on-chip in the 68040 improves floating-point performance. The heavy-duty parallel processing inside the CPU enables it to process instructions much faster than the 68030. Finally, the large caches operated in copyback mode mean even faster execution because off-chip bus traffic is minimized.

68881/68882FPUs. Each coprocessor has eight internal floating-point registers. Both conform to the ANSI/IEEE 754-1985 standard. The 68882 provides increased throughput via simultaneous execution of some floating-point instructions and special-purpose hardware for converting to and from the FPU’s internal format.

While the SANE (Standard Apple Numeric Environment) software can handle floating-point processing without special hardware, it does so by executing hundreds of instructions, which take time to execute. Dedicated FPU chips accomplish the same processing in silicon and at a much faster rate. If you require lots of number crunching, budget for an FPU (or the 68040 CPU with a built-in FPU).

As mentioned earlier, some accelerator boards ran into compatibility problems running the applications (although none had any problems running the BYTE low-level benchmarks). The result was typically a bomb box reporting a bus error or an illegal instruction error. When that happened, I would repeatedly try to rerun the application, each time disabling one of the accelerator board’s features until the application ran. Then I reenabled those features that did not cause the application to crash.

Sometimes the application refused to execute unless I completely disabled the accelerator board. In such cases, rather than run the test in nonaccelerated mode, I simply left that component out of my calculations of the index. (I did, however, note those cases where compatibility problems arose.) Indexes are listed in the table.

Top Accelerator Boards
I found it difficult to make generalizations about the value of individual boards because performance is so application-specific. It seems more appropriate to make a variety of recommendations. For my money, the Gemini Ultra is a top choice for speeding up a bare-bones SE. Not only does it let you take the SE up to a whopping 64 MB, but you can also tack on the optional video adapter and add a large-screen monitor. The board’s no slouch, either, turning in the highest CPU index for SE upgrades and the second-highest FPU index of all the accelerator boards I tested.

For pure speed, the Performance/040 scored highest. I shouldn’t let pass, however, the fact that the Performance/040 had some difficulties running some of the BYTE benchmark applications—Word 4.0 and Adobe PageMaker 4.0, for example. continued
Keyboards
Fujitsu 101-key enhanced keyboard
Part no.: 2B17128
Product no.: FKB4700
$79.95

Floppy Disk Drives
Toshiba 1.44MB
3.5" Internal Floppy Disk Drive
Part no.: 2B40774
Product no.: 356KU
$99.95

Memory
SIMM Module
Function: 1MBx9 80ns
Part no.: 2B41769
Product no.: 421000A9B-80
$47.95
DRAM
Function: 1MBx1 80ns
Part no.: 2B42251
Product no.: 511000P-80
$4.99

Computer Cards
16-bit VGA Card
Part no.: 2B67459
Product no.: VG7700
$99.95

Cables, Gender Changers, and Adapters
6-foot parallel DB25-pin male to Centronics male printer cable
Part no.: 2B28716
Product no.: PPC6
$7.95
DE9 female to DB25 male serial adapter
Part no.: 2B10305
Product no.: AD925
$4.95

Hard Drives (IDE)
Capacity: 120MB
Speed: 19ms
Part no.: 2B14074
Product no.: CP30104
$389.95

Power Supplies
150 watt 8088
Part no.: 2B19465
Product no.: JE1030
$69.95

Jameco offers a full line of competitively priced computer products for immediate delivery. Select what you want from our 100-page catalog. Priority orders placed before 2:00PM(PST) are shipped the same day. All products are backed by our customer service experts and a 30-day full-refund guarantee. Once you buy, you'll understand why millions of customers have been choosing Jameco for over 20 years.
NEW TRICKS FOR SLOW MACS

As I mentioned earlier, the 68040 doesn’t always get along with some applications, so for mission-critical ones, contact Impulse Technology for a compatibility list.

Finally, for sheer ingenuity, I liked the Mobius board as an upgrade for the Classic. The wraparound design of the board and sneaking the external monitor connector through the Classic’s grill indicates an engineering department with a tenacity that deserves some kind of recognition.

Rick Grehan is technical director of the BYTE Lab. You can contact him on BIX as “rick_g.”

Company Information

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Circle Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Engineering</td>
<td>(Transwarp CI)</td>
<td>(214) 241-6060</td>
<td></td>
<td>1060</td>
</tr>
<tr>
<td>Brainstorm Products</td>
<td>(Brainstorm)</td>
<td>(415) 964-2131</td>
<td></td>
<td>1061</td>
</tr>
<tr>
<td>DayStar Digital, Inc.</td>
<td>(PowerCache)</td>
<td>(404) 967-2077</td>
<td></td>
<td>1062</td>
</tr>
<tr>
<td>Dove Computer Corp.</td>
<td>(MaraThon Racer)</td>
<td>(919) 343-5600</td>
<td></td>
<td>1063</td>
</tr>
<tr>
<td>Extreme Systems</td>
<td>(Impact, Vandal SE)</td>
<td>(206) 575-2334</td>
<td></td>
<td>1064</td>
</tr>
<tr>
<td>Fusion Data Systems</td>
<td>(TokajMac)</td>
<td>(512) 338-5326</td>
<td></td>
<td>1065</td>
</tr>
<tr>
<td>Harris Laboratories, Inc.</td>
<td>(Performer2)</td>
<td>(612) 941-2948</td>
<td></td>
<td>1066</td>
</tr>
<tr>
<td>Impulse Technology, Inc.</td>
<td>(Performance/040)</td>
<td>(404) 889-8294</td>
<td></td>
<td>1067</td>
</tr>
<tr>
<td>MacProducts USA, Inc.</td>
<td>(Raingun Pro 030)</td>
<td>(512) 472-8881</td>
<td></td>
<td>1068</td>
</tr>
<tr>
<td>Mobius Technologies</td>
<td>(Mobius)</td>
<td>(510) 654-0556</td>
<td></td>
<td>1069</td>
</tr>
<tr>
<td>System Technology Corp.</td>
<td>(a division of Novy Systems, Inc.)</td>
<td>(904) 428-0411</td>
<td></td>
<td>1070</td>
</tr>
<tr>
<td>Total Systems</td>
<td>(Gemini Ultra, Voyager 030)</td>
<td>(503) 345-7395</td>
<td></td>
<td>1071</td>
</tr>
</tbody>
</table>

The First Diagnostic that’s All PRO and No CON.

Check/It PRO: SysInfo provides the most accurate and comprehensive configuration data ever available. Whether you’re planning an upgrade, trying to find a set-up problem, or simply becoming familiar with a new system, Check/It PRO: SysInfo has the information you need.

• Processor/Co-Processor Model, Manufacturer, and Speed (MHz)
• Detailed Memory Maps: Base/UMB, EMS, XMS, TSRs, Device Drivers and Interrupt Vectors
• REAL Hard Drive Geometry, Model, and Interface Type: MFM, RLL, IDE, SCSI & ESDI
• Detects Network, Modem, FAX, CD-ROM, and Sound Card Details
• Edit/Save/Restore CMOS, plus DOS & Windows System Files
• Performance Benchmarks compared to Standard or Custom System Profiles
• Built-In Technical Reference Library

The PR0s and CONs of SysInfo Utilities

There’s a real difference in the information displayed by Check/It PRO, and other utility programs. For example, Check/It PRO determines the “live” status of each IRQ — but other programs just show you “standard” assignments. Check/It PRO also tests your hard drive to find out what type of drive is really attached, not just how CMOS is set up. If it was easy, every program would provide this type of information; but the only one that does is Check/It PRO. No matter what other program you have, you need Check/It PRO too.

Try it for yourself. We think you’ll agree that the new Check/It definitely qualifies as a real PRO.
APPLICATION

The Second Premiere

TOM YAGER

There is every reason to expect that Premiere 2.0, Adobe’s QuickTime movie-editing system, will cause as much commotion as the original package did when it started shipping a year ago. Back then, Premiere was the first such application, but it was only one of many pieces Macintosh users required to create a complete QuickTime movie (see “Two Tools of the QuickTime Trade,” June 1992 BYTE, and “Cut to Video: Four Programs for Moving Presentations,” November 1992 BYTE).

The new Premiere brings more of those pieces together in one package. Version 2.0 has its own video-capture module and tiler. It also offers remote control of video decks, and it can export EDL (edit decision list) files for use in full-size editing suites. These additions help make digital video affordable for those who now use analog video or who long for the versatility of broadcast equipment but can’t justify the cost.

Building the Set
Premiere 2.0 runs on a Mac IIci or better with 8 MB to 20 MB of memory and a 24-bit graphics card. Premiere will run under System 6.0.7, but System 7.x is preferred. I tested Premiere on both a Mac IIci with an Apple 8•24 GC graphics card and a Quadra 700 with a SuperMac Spectrum 8•24/PDQ graphics card. I ran the IIci with a total of 8 MB of memory. The more powerful Quadra carried a total of 20 MB. I used the SuperMac VideoSpigot, a leading QuickTime capture board, in both test systems.

The Quadra supports digitized audio; I had to equip my IIci with Macromedia’s MacRecorder Sound System Pro, an external sound digitizer that plugs into the serial or printer port. The Quadra’s audio input is microphone-level; I had to use an attenuating patch cord to make the line-level output of my Panasonic AG-7650 Super-VHS VCR usable.

As it stands, the best that either the internal or external Macintosh audio-digitizing solutions can offer is 22 kHz at 8 bits. Support for 44-kHz audio is supposedly on its way from Apple, and a future upgrade to QuickTime and Sound Manager will bring high-quality audio to Premiere.

Makeup
Premiere’s main interface hasn’t changed much since the original release. The landscape (see the screen) is dominated by a construction window, in which you assemble tracks of video and audio. Adobe added a preview window in version 2.0, so you can now see a single assembled frame from any point in your sequence. Also new is the movie-capture window. It shows the capture board’s input in real time (for focusing, tape positioning, and other adjustments) and provides the interface through which you set various recording preferences.

For the movie-capture feature to work, Premiere requires a VDIG (video digitizer) that matches the capture board you’re using. This provides a device-independent layer that Premiere and other QuickTime applications can use to build in capture capability with minimal hassle. Premiere doesn’t ship with VDIGs; they all come from capture-board vendors. At press time, VideoSpigot’s VDIG was still in beta testing, but fully functional.

Premiere’s capture interface calls out to the VDIG not only to capture video but also to adjust the capture board’s settings, select the frame rate and compression method, and otherwise tune the capture system. Video can also be brought into Premiere in real time or one frame at a time. If you connect your Mac to a VCR through VISCA, Diaguest, V-LAN, or another supported video transport control interface, Premiere automatically steps through a video and captures it frame-by-frame. You can then use Premiere to digitally edit that video and record it back to a single-frame-capable VCR one frame at a time. It’s a time-consuming operation, but the resulting video is of much higher quality than with real-time capture and playback, and it becomes the rough equivalent of an editing suite for those long on patience but short on cash.

The Cutting Room
To edit video, you drag a clip into one of the construction window’s tracks. There are three tracks of video (titles and graphics count as video) and three tracks of audio. You can mix the audio tracks any way you like. You can alter the playback volume of each audio track over time by...
moving points on a graph for cross-fades and other dynamic effects. If a video clip has attached audio, they are locked in sync and placed together in the construction window. Stand-alone audio clips containing music, narration, or sound effects can be dragged in and aligned with any location in your video.

**Transition Choices**
Mixing video tracks is more involved. There are two main video tracks (A and B), and one “super,” or superimposition, track. The A and B tracks are mixed according to their overlap, and icons are dragged into the FX (transitional effects) track. A cut edit is arranged simply by butting the end of one clip against the beginning of another (in either the same or different tracks). If A and B overlap, an FX icon can be placed between them to arrange a transition.

The transitions are varied, running the gamut from simple wipes and dissolves to page turns and cube spins. You can gain a more professional look by adding colored borders and antialiased edges to transitions that use moving shapes. When appropriate, transitions can be adjusted to create unique effects. A zoom transition can be stopped in the middle, for example, for a picture-in-picture effect.

The primary duty of the super track is handling titles and overlaid graphics. Premiere has a versatile software keyer that simulates many functions provided by broadcast video keyers, including chroma (color) and luminance (brightness) keying and image mattes (video is played through a text or graphical shape). One particularly exciting key mode is the difference keyer: It compares each frame of video to the one before it and makes everything that doesn’t move transparent. So if you shoot a basketball game with a stationary video camera, you can extract just the parts that move (the players and the ball) and lay them in front of another video source.

Motion effects, a new feature, let you animate the movement of a video or graphical clip through the viewing area. The animation follows a path you create, and at each point in the path you can apply rotation, scaling, and distortion to create wonderful pseudo-3-D effects.

In addition to transitions and key effects, you can apply filters to video clips to change their appearance. There are 41 filters in all, and most of them are special-effects oriented. You can create an undulating dream-sequence effect, make your video ripple like waves in a pond, or spin your video into its center like water down a drain. More practical filters handle tinting and colorization, gamma and color correction, and filter blending.

**Weak Links**
Unfortunately, filters are one area where Premiere 2.0 falls short. Its filters change the clip’s contents directly, and they can only be applied to an entire clip. I found that limiting: I wanted the freedom to drag out a section of a clip and apply a filter to it (a competing package, Diva VideoShop, allows this). You can easily split a clip into two clips and apply a filter to one of them, but that’s an awkward workaround.

Another Premiere flaw is an ironic one: It has so much power that some of it is hard to find. You can, for example, make a video clip fly in from a corner, spinning and tumbling as it comes. I would expect to do that as part of a transition, but that’s not how it works. Instead, you have to apply a motion effect to a clip and then superimpose it to create a transition from scratch. That’s typical of Adobe tools: Between Illustrator and Photoshop, you can accomplish almost anything you want, but you can also make a career of learning how.

The final weak link in Premiere is its integrated titler. Premiere creates very nice-looking antialiased text (antialiased in the alpha channel, no less), but it comes up disappointingly short in other areas. All colors must be solid—no patterns, image maps, or gradations are allowed. But you can specify a transparency level. Text cannot be rotated or scaled (even though Premiere includes Adobe Type Manager), and the only available effect is shadowing. The integrated titler is better than nothing, but it seems Adobe would prefer you use Illustrator to create more interesting titles. It doesn’t fit with the rest of Premiere’s professional features.

Once you have lined up everything—video, audio, and effects—you can use the preview window to look at any section of your project. You can view either a reduced-rate moving preview or a snapshot of a particular frame. The snapshot is extremely helpful because you can instantly see whether the transition or superimposition effect you’ve chosen works as you expected.

When you are satisfied with what you see in preview mode, you can generate a finished QuickTime movie of your job. At this point, you can see your work at the frame rate and resolution you choose, and you can apply your choice of video compression techniques. If you’re dissatisfied with any of the results, you can feed the movie back into Premiere for additional editing.

**Digital Partner**
Premiere 2.0 is a welcome partner for those who use digital video but who aren’t ready for more expensive, more capable digital nonlinear editing systems. The program’s ability to control external video equipment and output EDLs not only helps Premiere suit existing video studios but also gives all its users room to grow.

The application doesn’t do everything, or do everything right, but it remains the standard against which other QuickTime editors are judged. The quality of the material Premiere pumps out (provided you create your titles elsewhere) is as good as QuickTime can manage. Premiere may take some learning to use well, but it’s time well invested.

Tom Yager is director of BYTE’s Multimedia Lab, a multimedia consultant, and the author of The Multimedia Production Handbook for the PC, Macintosh and Amiga (Academic Press, forthcoming). He can be reached on BIX as “tyager” and on the Internet at tyager@bytephbyte.com.
Microsoft's new Visual Basic for DOS may earn converts among those bigoted against BASIC. This is a programming system unlike any other (except perhaps Visual Basic for Windows). In one box come all the tools you need to write serious BASIC applications. The standard edition ($199) features an integrated environment—editor, interface builder, debugger, compiler—and a set of interface objects for building professional-looking applications. The professional edition ($495) adds features that seasoned Microsoft BASIC programmers expect, like ISAM (indexed sequential-access method), graphics, overlays, and 386/486 optimizations. And this package offers one feature that is truly hard to find: near-automatic conversion to Windows.

Power Tools
I evaluated the professional edition of VB-DOS on a handful of systems, including a Dell 450SE 486/50 tower and a Toshiba T2000SX notebook. This gave me a good feel for its performance. One of the most significant aspects of the program is the integrated environment. It, like the programs you create with it, delivers to a remarkable degree the Windows look and feel in text mode. If it weren't for the jumpy reverse-video block that's supposed to be the mouse cursor, the emulation would be almost complete.

Developing applications under VB-DOS is a lot like using its Windows counterpart. VB-DOS is a highly modular system in which each separable block of code is edited in its own window and proper programming style is enforced. Start a new function definition under the one you've just written, and VB-DOS will instantly open a new window and move your function definition to it. If you just keep typing, you won't even notice.

This is important when you're editing large, multinode applications. The environment knows all the function and subroutine names you've used and can pop up some named portion of your code in a flash. If your project has multiple files, VB-DOS lists the files in a box on the right side of the display, so you can hop from module to module with ease. You no longer have to remember which file the function you're looking to edit is hiding in. You can have multiple edit files open at once or, to save screen space, do all your editing in a single edit window that switches from file to file.

The Big Event
VB-DOS programs should be event-driven if you wish to take full advantage of the environment's power. Most events come from user-interface objects, and the interface builder is an integral part of the VB-DOS system. Interfaces are drawn in much the same way as with Visual Basic for Windows (see the screen). Double-clicking on an interface object brings up the BASIC code attached to that object. Code segments are mostly attached to interface objects' events (like mouse-clicks and key presses).

The objects are “smart”—that is, they have designed-in behavior that you don't need to program. The text object, for example, already knows how to process text. If you drop a bunch of different interface controls together in a window, VB-DOS assigns a default tab order so users can move among them with the tab or arrow keys. All you really have to add is code describing the action you wish to take in response to the input events you choose to pay attention to. Any input not actively processed by your code is discarded. This is a boon for prototyping and testing interfaces as you build your application.

BYTE ACTION SUMMARY

- WHAT VISUAL BASIC FOR DOS IS
  An integrated environment for creating compiled, event-driven DOS applications with BASIC.

- LIKES
  Suitability for all classes of programmers; Windows portability.

- DISLIKES
  Interface support for DOS text mode only; overlays required to get past 640 KB.

- RECOMMENDATIONS
  It's the one programming tool you can't live without.

- PRICE
  Standard edition, $199 ($99 for Microsoft BASIC owners); Professional edition, $495

- FOR MORE INFORMATION
  Microsoft Corp.
  1 Microsoft Way
  Redmond, WA 98052
  (800) 426-9400
  (206) 882-8080
  Circle 1226 on Inquiry Card.
**A BASIC BREAKTHROUGH**

DOS text-mode limitations on screen space and memory become apparent when you start switching between the code and interface-building portions of VBDOS. If you go from the integrated environment to the interface builder, for example, the screen goes blank for a few seconds, and then the interface builder appears. The integrated environment goes away until you exit back to it. This is the only place where the integration comes apart. I had been developing in Windows for so long that I forgot all about DOS’s shortcomings and the dirty tricks required to work around them. The VBDOS executable will use EMS or XMS (Extended Memory Specification) high memory as swap space if you tell it how much it can use at launch time.

**Multiple Goals**

In releasing VBDOS, Microsoft has several goals to please: Windows developers who also want their programs to run under DOS (and vice versa), experienced QuickBasic and Microsoft BASIC developers, and people who don’t normally write their own programs.

VBDOS directly supports taking a Visual Basic project from Windows to DOS; since the DOS version came last, Microsoft was able to build Windows file compatibility into it. To go from DOS to Windows involves either saving individual form (i.e., interface) and code module files as ASCII or running the whole shooting match through a Windows-based project translator (included with VBDOS).

All the standard interface elements are supported on both sides, and the underlying languages are almost identical. Microsoft even provides DOS clipboard and printer objects that support enough functionality to make porting go more smoothly. Perhaps more remarkably, the Windows MDI (Multiple Document Interface) is emulated. Most small projects just translate on the first try, but it depends mostly on how many Windows- or DOS-specific things you try to do. Custom controls and extensions (like ISAM) on either side are not portable, but that’s to be expected. What brings it all together is the marvelous documentation: A well-written appendix covers conversion in both directions and spells out the issues.

Microsoft also goes out of its way to accommodate QuickBasic 4.5 and BC 7.x users. The manual includes a detailed accounting of the differences between Microsoft’s BASIC languages (including GWBASIC) and offers lots of ways to work around those differences. QuickBasic and BC code can be loaded directly; unlike Visual Basic for Windows, the DOS version will run virtually any old-fashioned, non-event-driven BASIC program with a minimum of adaptation. Smart programmers, however, will take the manual’s advice and convert instead of copy to take advantage of the new features Visual Basic places at their disposal.

**Eyes of the Beholder**

The “visual” aspect of Visual Basic for DOS is more than skin-deep. VBDOS applies advanced software development techniques in a unique combination that DOS programmers haven’t experienced before. I’m a Visual Basic for Windows fan, so I expected to be disappointed by the DOS version. Not only was I impressed, but I realized that VBDOS has some key advantages over its Windows counterpart. These include a native-code compiler (with optional 386/486 optimization). In addition, DOS programs have the advantage of running under Windows as well (they run very nicely in the Windows DOS box).

Other benefits are the professional edition’s integral ISAM database support and the software’s ability to build applications into single-file stand-alone executables. Although there’s a lot about VBDOS that’s impressive, it does have shortcomings. First, I would have liked better support of DOS systems running in graphics modes. This would have made some limited multiformat capability available, with a trade-off in display performance (this mode can be seen in Microsoft Works for DOS). It might also have made for better support for graphical elements like icons and window border controls. I would also like to see more transparent support for extended memory. As it is, you must resort to overlays and command-line tools (specific to the professional edition) in order to get your applications over the 640-KB hump. That makes large Windows programs difficult to port and heavy-duty DOS applications more work than they have to be.

Overall, I think Microsoft hit the nail right on the head. VBDOS adequately meets the needs of serious and casual programmers, Windows and DOS programmers, and BASIC and other-language programmers. I can’t think of a class of the code-writing public whose lives wouldn’t be made easier with this system. If Microsoft keeps this up, it’ll give BASIC a good name.

---

Tom Yager is director of the BYTE Multimedia Lab and a proud BASIC programmer from way back (but he also writes in C). He can be reached on BIX as “tyager” or on the Internet at tyager@bytepb.byte.com.
Forging a Business Tool: Three Fax Software Packages for Windows

STAN MIASTKOWSKI

I’ve used fax software on and off for several years, and I have usually been disappointed. It was often difficult to set up and use, and the results were mixed. In large part, Windows-based fax software has changed that. This new generation of fax software makes computer-based faxes an essential business tool.

For this review, I looked at three packages that just came out: Eclipse Fax, Caere FaxMaster, and ZSoft UltraFax. All three sell for under $150, and they give you a good idea of the range of products (with very different abilities) available today. (The latest version of Delrina’s WinFax, the application that you can switch on and off, but you’ll need a fax modem that will receive and send faxes (not all do).

If you want to send a quick one-page fax, all the programs offer a direct-send feature. The fax driver intercepts the print output, converts it to a graphical fax image, and sends it on its way. All three packages offer automatic fax reception that you can switch on and off. And each package lets you integrate an external scanner for importing pages that aren’t stored in your computer. Finally, further underlining the fact that Windows and fax software are made for each other, if you’re running Windows in the enhanced mode or using a modem with its own processor (see below), you can work in an application while a fax is being received or sent in the background.

A word to the wise: Fax programs don’t stand alone. They’re advisable to invest in the best fax modem you can afford. If you need to fax many documents that aren’t in your computer, you’ll also need a scanner, which can cost more than a high-quality stand-alone fax machine. The bottom line is that the cost of a fax program is only a small part of the expense you incur when you set up a computer-based fax system. However, if they match your needs, programs like these can give you a highly integrated fax setup that can save you time and money.

I tested these fax software packages using an Intel Satisfaxtion Modem/400e internal unit and a SupraFaxModem V.32bis external unit. The Intel Satisfaxtion is an add-in card with its own 186 processor and RAM, taking the fax send/receive chores away from the PC’s processor. It also conforms to CAS (Communications Applications Specification). The Supra unit is a class 2 (i.e., send/receive) fax modem, where the fax software communicates directly with the modem.

Eclipse Fax

When you launch Eclipse Fax, you see a plain screen with five pull-down menus. I found this simplicity useful and elegant, because you get the information you need without overwhelming your brain. When a fax is being received, a small screen pops up to tell you the status of the fax. Ditto for when you are sending one.

Nevertheless, there’s intelligence and some unique features hidden behind the plain face of Eclipse Fax. For instance, the program offers an indexing feature that’s useful if you store a lot of short faxes. When you receive a fax, you can enter a name (up to 50 characters) in the index box. It’s essentially an extended filename, not a true database, but it’s eminently useful. As you receive and store more faxes, you can scan through the list and quickly

Screen 1: Eclipse Fax offers a straightforward user interface and the ability to show a thumbnail of a received fax.
find the fax you want to retrieve.

Eclipse Fax's View option is fast, displaying faxes on the screen almost instantly (see screen 1). Most other packages can take from a few seconds to several minutes to go through the translation step before displaying the fax, depending on how long the fax is and how fast the PC is.

Another nice feature of Eclipse Fax is that it lets you annotate faxes in the View mode. If you want to type comments on the received fax before storing it or returning it to the sender, you just position the cursor and type away. You can also use drawing tools to mark up the fax.

Eclipse Fax uses Clearview technology. This feature removes miscellaneous spots and lines from the fax and enhances characters that didn't come through completely formed.

The package requires only a half-megabyte of disk space, the smallest amount of the three applications I reviewed and a size that allows it to work well with a portable computer. But unlike the other two programs covered in this review, Eclipse Fax doesn't include OCR (optical character recognition), so it won't translate the words in your received faxes into ASCII.

Caere FaxMaster

With FaxMaster, Caere is branching out from just OCR products to full-fledged applications. FaxMaster is definitely the company's flagship application.

As you would expect, FaxMaster focuses on converting received faxes into computer-readable form. If you receive many long faxes that must be edited or rewritten, FaxMaster can save you a lot of time. You can set up the program to automatically convert a fax when it's received or to perform the process later. Faxes can be converted to ANSI, ASCII, Microsoft Excel text, or Microsoft RTF (Rich Text Format). You can use the program's direct-input feature to insert a converted fax into the application (and file) of your choice.

The program's interface is highly graphical, with six icons for common operations (e.g., viewing printing, scanning, and recognizing faxes). Since many faxes are viewed and discarded quickly, FaxMaster provides a handy trashcan icon for immediate deletion. I like that. (See screen 2.)

FaxMaster requires almost 4 MB of disk space. A large part of that is the OCR engine, which Caere dubs AnyFax.

FaxMaster's image-recognition abilities are impressive. I sent it a page produced by desktop publishing software that included several fonts and various type sizes. I even tried to confuse it by placing several graphics on the page. FaxMaster identified and blanked out the graphical images and performed text recognition with a high degree of accuracy.

However, fax conversion requires a lot of processing horsepower. The OCR process is an order of magnitude faster on my 33-MHz 486 than on a 16-MHz 286.

The higher the quality of the received fax, the more accurate the recognition process is. The page I produced with desktop publishing software and sent to FaxMaster was sent from the application through a fax modem to another fax modem using the fine mode (i.e., 200 by 200 dots per inch). FaxMaster easily performed an accurate translation with a direct fax-modem send using the standard fax mode (200 by 100 dpi). However, FaxMaster had problems with a typewritten page that was sent from a well-used standard fax machine. That's not the program's fault. FaxMaster's image recognition is impressive and useful, but don't expect miracles if it receives a noisy or streaked fax.

Caere offers a compression feature dubbed SuperCompression that's handy if you store faxes rather than convert them to text. A fine-mode fax that's a few pages long can take up a megabyte or more of disk space, because it's essentially a large graphical image. SuperCompression uses a proprietary method of compressing images. Caere claims that this feature produces a compression ratio of up to 33 to 1.

SuperCompression works, and it's useful, especially if your hard disk is rapidly running out of space, like mine.

continued
Just when you thought you had us pegged for building fiery-hot graphics cards we decide to throw a curve ball. And this one's aimed directly at your ears: the new Orchid Sound Producer Pro. An easy-to-load board that features a phenomenal 20-voice synthesizer, delivers sampling rates up to 44.1 KHz and is 100% compatible with SoundBlaster Pro, along with three other sound standards—Disney Sound Source, AdLib and Covox Speech Thing. MIDI support, joystick port, microphone, speakers and our exclusive Voice Notes (for audio post-its) are bundled for an absurdly low $199. For more details, call 800-7-ORCHID. Or fax: 510-490-9312. And prepare to sample true audio ecstasy.
FORGING A BUSINESS TOOL

ZSoft UltraFax
Integrating useful features into an application and making it easy to use isn't a simple process. ZSoft's UltraFax is the largest program of the three I've reviewed here, requiring over 4.5 MB of disk space. It has a raft of features, but many of them aren't obvious.

UltraFax has a complex user interface; however, to its credit, it has nice big buttons on the main screen for common operations (including a trashcan; see screen 3). You can customize almost anything in UltraFax, including the look and feel of in boxes and out boxes.

UltraFax, including the look and feel of in boxes and out boxes.

ZSoft developed the popular PC Paintbrush graphics program, and UltraFax has numerous graphics abilities. Just as with Eclipse Fax, you can draw on and annotate faxes. There's also a large selection of cover-page templates, ranging from the serious to the near-ridiculous.

UltraFax is unique among these three packages because it can import existing databases and export phone books to other programs. Other useful features in UltraFax include the ability to send binary files (at 9600 bps) to other computers running UltraFax. There's also a handy archiving feature (not unlike the one in Eclipse Fax) that allows you to index stored faxes.

UltraFax also offers OCR. Its accuracy doesn't match Caere's software. UltraFax's line-by-line character recognition was slower and more easily fooled than FaxMaster's, and it required a high-quality, direct-send, fine-mode fax to achieve a high degree of accuracy.

Of the fax programs covered in this review, only UltraFax makes extensive changes to your Windows WIN.INI and SYSTEM.INI files. That's not unusual among Windows applications in general, but one of my pet peeves is installation programs that neither make backups of the Windows system files nor give you an “uninstall” option that puts everything back the way it was. UltraFax does neither, and I spent a lot of time changing and cleaning up files after I finished my review.

Making a Choice
The range of Windows-based fax programs available today gives you many choices, depending on how many faxes you send and receive and what you want to do with them.

For simplicity and usefulness, Eclipse Fax is the obvious choice. If you have to convert faxes into computer-readable text files, choose Caere's FaxMaster for its outstanding OCR technology.

Stan Miastkowski is a BYTE consulting editor and a freelance writer. He can be seen regularly on the “PCTV Live” syndicated TV show and is the coauthor of Windows for Workgroups Bible (Addison-Wesley, forthcoming). You can reach him on BIX as “stanm.”

ITEMS DISCUSSED

Eclipse Fax......................................$119
Caere Corp.
100 Cooper Court
Los Gatos, CA 95030
(408) 395-7000
fax: (408) 354-2743
Circle 1230 on Inquiry Card.

FaxMaster......................................$149
ZSoft Corp.
450 Franklin Rd., Suite 100
Marietta, GA 30067
(800) 227-5609
fax: (404) 428-0008
Circle 1231 on Inquiry Card.

FAX MODEMS

Intel Satisfaxtion
Modem/400e......................................$549
Intel Corp.
5200 Northeast Elam Young Pkwy.
Hillsboro, OR 97124
(800) 538-3373
(503) 696-8080
Circle 1232 on Inquiry Card.

SupraFaxModem V.32bis..$399.95
Supra Corp.
7101 Supra Dr. SW
Albany, OR 97321
(800) 727-8647
(503) 967-2400
fax: (503) 967-2401
Circle 1233 on Inquiry Card.
YES! Enter my one-year (12 issues) subscription to BYTE for only $24.95.* I’ll save 40% off the single copy price. Plus, I’ll also receive BYTE’s Annual Special Issue FREE with my paid subscription. If at any time I’m not satisfied with BYTE, I may cancel for a full refund on all unmailed copies.

Payment enclosed  Bill me later

NAME

COMPANY

ADDRESS

CITY  STATE  ZIP

Please allow 4-6 weeks for delivery. Basic subscription rate is $29.95. (Mexico, $29.95 payable in U.S. funds.) Above rates are for U.S. delivery only. Please see table of contents for international subscription rates.

*Plus applicable state and local tax, if any.
data modem, a fax, and a voice-mail system are three essential components for setting up communications in a small business. Instead of requiring you to install and mediate each of these devices separately, a new group of products now pack these components onto single internal PC cards. You get complete messaging systems at a reasonable cost, but can these new fax/modem/voice cards get the job done?

To find out, I evaluated two PC messaging systems: Complete Communicator Gold, a faster version of The Complete PC's flagship product; and Home Office, a new offering from Prometheus Products (I've also seen a preproduction version of a new PC messaging system from National Semiconductor; see "A National Voice for the PC" on page 67). The idea seems to be catching on.

Common Ground
Both of the shipping products share basic design features. A single internal card holds a Hayes-compatible data modem offering industry-standard data compression (for file-compression rates of up to 4 to 1) and error correction, a 9600-bps Group 3 fax, and voice messaging. The modem on the Complete Communicator Gold ($699) runs at 9600 bps. (For $499, you can get the standard Complete Communicator with a 2400-bps modem.) The Communicator cards include a scanner port for an optional Complete PC scanner.

Home Office, equipped with a 2400-bps modem, sells for $299. Prometheus also offers a version of the product with a 14.4-Kbps modem, called Ultima Home Office, but an evaluation unit was not available at press time. Ultima Home Office costs $539 and includes the same software interface as the lower-end product.

The packages ship with fax and voice-messaging software for both DOS and Windows. A DOS communications program is also included with both products. With the Windows fax software, faxing services are available directly through a printer driver (see page 209 for a related review of Windows-based fax software).

From any Windows application, you can generate a fax job by selecting the Print option from the main menu. The driver will then load, allowing you to assign a recipient, select a cover page, and deliver the fax. Both products also include a dedicated fax application for tracking your jobs, examining incoming faxes, generating cover pages, and sending files directly. The hardware can sense the state of an incoming call—data, fax, or voice—and automatically switch to the proper receive mode. Fax and voice messaging operate in the background, so you don't have to interrupt your work to service calls.

The Home Office software keeps a single log of its transactions. From a window (see the screen) you can keep track of all your messages, both voice and fax. Clicking on a log entry plays a voice-mail message or loads a received fax to the viewer. The Communicator keeps voice messages and fax receipts in separate logs that must be accessed from different applications (the screen shows the voice-mail component). In fact, even within the voice-mail application, each mailbox keeps a unique log that must be opened separately, and when a new message comes in, you have no way of knowing where the new message ended up. The pop-up box alerting you of new messages should also tell you which mailbox the message went to. The Home Office approach, offering one-stop management of all your message traffic, is more convenient, but separate logs ensure additional privacy and security.

While the Home Office software has the advantage of simpler design, the Communicator's software proved more stable and full-featured. For instance, Home Office created TIFF files that other applications could not load. A number of applications—including Conversion Artist, Image Pals, and Picture Publisher—refused to load Home Office TIFFs. In general, the software sometimes seemed incomplete, stylistically (e.g., text was not properly aligned within a box or button) and functionally (dragging an entry from the phone book to the delivery box did not work consistently).

Take a Message
Voice messaging sets these products apart from the crowded fax/modem field. Again, both products share the same basic operation but differ in design and scope. With either product, you can set up multiple voice
mailboxes and attach different greetings to each mailbox. The Communicator lets you store multiple greetings for each mailbox so that a set of customized greetings is always readily available. With Home Office, you can have only one greeting stored for each mailbox. Each time you want to change the greeting, you've got to record a new one.

Multiple mailboxes let you route calls more efficiently. Each individual in a department or small business can have a custom password-protected mailbox available to any caller who enters the proper Touch-Tone sequence. The main greeting could then tell callers how to reach different mailboxes. Unfortunately, Home Office supports only two levels of mailboxes. After entering a Touch-Tone code to reach a secondary mailbox, the caller can't enter another code for further routing. This limits your applications. You couldn't, for instance, have callers enter a code for product information and then have them enter a second code depending on the particular product they're interested in. You can develop this type of system with the Communicator.

Both products also let you listen to your voice-mail messages through the telephone handset or by plugging speakers or headphones into a jack on the board. The Home Office card includes an on-board speaker, but the audio quality is too poor to be useful.

Home Office supports call screening. You can listen to an incoming message through an external speaker or headphone. If you then wish to pick up the call, Home Office automatically terminates voice mail, leaving you free to talk to the caller. The Communicator has no screening feature, but you can pick up the line even after voice mail has kicked in. And the Communicator supports Caller ID, so if you have this in your area, you can screen the phone number of the incoming caller when it appears on your computer display.

Remote Access
Like the Communicator, Home Office lets you call in from a remote phone to retrieve messages from any mailbox, and both have a valuable feature called Toll Saver. If you call in to check your messages but there are no new messages to retrieve, the system will allow an extra ring so that you can hang up and avoid a long-distance charge. With either system, you can call in remotely to retrieve messages from any mailbox, as well as delete old messages from the system. But the Communicator goes much further. Using Touch-Tone codes, you can perform almost any function available from the Windows interface: selecting and recording greetings, changing passwords, and even reconfiguring the system.

The Communicator has a clearly superior feature set. You can forward a received message to another phone or create your own messages for the Communicator to deliver. For example, you could record a voice reminder of an upcoming meeting and then automatically send the message to a group of recipients. The Communicator will then dial up each recipient and play the recorded message. You can also rename the messages in your log, assigning meaningful names—such as the name of the caller—to keep better track of your messages. And the Communicator can call you at another location (or call your beeper) when new messages arrive on the system.

Viable Voice Mail?
Integrating a modem, fax, and voice mail on a single adapter board sure seems like a good idea. It delivers vital communications services at an affordable price. But there are some drawbacks. Voice messages require plenty of disk space—200 KB for each minute of recorded voice. The Home Office helps some by giving you the option of recording at lower sampling rates, thereby saving disk space but degrading the audio quality. You will still need a hefty hard drive to hold a reasonable volume of voice mail. Memory resources are also taxed: The Home Office TSR program consumes just under 100 KB while the Communicator eats up about 144 KB.

Both products lack multiline support. As your business starts growing, your customers may hear a busy tone too many times. These systems also need more programmability. In particular, the Home Office limit of only two levels of mailboxes is not sufficient when you're trying to create a customized voice-mail system. Deeper levels of mailboxes is a good start, but programmable firmware is what's needed. The preproduction TyIN 2000 card from National Semiconductor features a programmable processor. The BIOS code is downloaded into DRAM on boot-up, not held in a permanent ROM. This not only allows future upgrades (such as color or fax, or more advanced error correction) to be delivered via software disks, but it also enables you to customize the system with your own software code.

The limitations of these products are, for the most part, restrictions of scale. If your business is big enough to have its own PBX, these products will not do the job for you. They seem best suited to small start-ups and home offices that want to minimize equipment costs. For those businesses, the Complete Communicator Gold offers an impressive set of features and stable operation. Support for multiple mailbox levels is especially notable. Home Office carries a lower price tag, but the software isn't mature enough to recommend. There are some interesting developments to keep an eye on, but in the current market, the Communicator is still the one to beat.

Stanford Diehl is a BYTE Lab technical editor covering graphics software, peripherals, and add-ins. He can be reached on BIX as "s_diehl."
Windows and Unix don't seem like a natural match, but the popularity of Windows as a client platform and Unix as a host makes finding ways to connect the two a common problem. DOS users have long enjoyed access to Unix services through products such as FTP Software's PC/TCP, but similar access through Windows (and with the Windows user interface) has been more difficult to come by.

I evaluated four products from three companies that bridge the gap between Windows and a TCP/IP environment. These four packages contain a Windows-compatible TCP/IP protocol stack, a client NFS (Network File System) component, and a collection of TCP/IP utilities. TCP/IP utilities allow Windows users to send and receive Unix mail, gain terminal access across a TCP/IP link, transfer files, run programs on another host, and join Unix print queues. NFS allows you to mount remote Unix file systems as networked PC disk drives.

The four products that I'll look at are BW-NFS 3.0 from Beame & Whiteside Software, Super-TCP for Windows version 2.00 and its companion Super-NFS Client 2.00 from Frontier Technologies, and ChameleonNFS 3.05 from NetManage. Each of these products provides at least ftp, ping, and telnet, and all of them provide a few other TCP/IP utilities. None, however, offers remote-shell functions (e.g., rexec and rsh) in a Windows interface.

I used SCO Unix 4.0 running on an IBM PS/2 Model 80 as the host. On the client side, I used my Compydene 4DX/33 notebook running DOS 5.0 and Windows 3.1. A Xircom pocket Token Ring adapter and its NDIS drivers provided access to the host through my token-ring LAN.

All the products installed easily, except for one minor protection-key problem with Super-TCP. BW-NFS isn't copy-protected, and ChameleonNFS intelligently uses TCP/IP messages to detect multiple copies of itself running on the LAN.

Why Windows?
Using Windows instead of a plain DOS interface to access the Unix host has several advantages. TCP/IP utilities such as ftp (which uses FTP to transfer files between the local PC and a remote host or between two remote hosts) get a friendlier interface. Operations that usually require command-line entries happen under Windows in response to push buttons, check boxes, and selections from listboxes.

ChameleonNFS and Super-TCP offer a memory-saving advantage. The TCP/IP protocol stack is in a Windows DLL instead of TSR programs and device drivers. You don't have to allocate precious base DOS memory to the protocol stack.

Unfortunately, the downside of the DLL approach is that you can't access the Unix host from DOS programs. To avoid this problem, Frontier Technologies packages a TSR protocol stack with Super-TCP that you can use as an alternative to the DLL. Beame & Whiteside doesn't offer a TCP/IP DLL; it supplies only a protocol stack in the form of TSRs and device drivers.

Another advantage of a Windows TCP/IP implementation is, of course, multitasking. Multitasking allows you to more closely simulate a Unix environment, because you can run host processes that give other users access to your system while you use it for other purposes. You couldn't make this work under DOS.

BW-NFS
You can set up BW-NFS to run on any network adapter that comes with NDIS or ODI (Open Data-link Interface) drivers. You can also use it with the Crynwr (formerly Clarkson) Packet Drivers or through a serial interface (using SLIP [Serial-Line IP]).

The TCP/IP-resident portion of the BW-NFS product took 31 KB in an NDIS, token-ring configuration (in addition to the NDIS drivers themselves). I was able to load all the resident software into upper memory with DOS 5.0, but 386Max could not load TCP/IP.SYS high.

BYTE ACTION SUMMARY

- WHAT TCP/IP STACKS FOR WINDOWS ARE
  - A TCP/IP stack and Windows-based Unix utilities for accessing Unix hosts from PCs running Microsoft Windows. They provide an NFS component for connecting to remote file systems.

- LIKES
  - ChameleonNFS's unique features, most notably its NFS host facility. It also has the best Windows interface to its utilities.

- DISLIKES
  - Documentation for Super-TCP for Windows; lack of remote-shell functions in any package.

- RECOMMENDATIONS
  - Get ChameleonNFS.

- PRICE
  - (Single user) BW-NFS 3.0, $349
  - Super-TCP for Windows 2.00, $395
  - Super-NFS Client 2.00, $90
  - ChameleonNFS 3.05, $495
Decisions, decisions, decisions.

Decider, decider, decider.

Down-sizing, upgrading, multi-platform environments. Today's computer hardware issues are more numerous, more difficult, more critical than ever. So how do companies make decisions?

According to a new IntelliQuest study, they turn to the only person qualified to decide. Someone like Bob Barrett. A person with 18 years in computers. Who oversees a technical staff of 75. And whose buying decisions and approvals affect nearly 3,000 users worldwide.

In other words, they turn to the BYTE reader. A full 92% of whom control the products and brands their companies buy.

If you want to reach an audience as influential as this, then yours is an easy decision—advertise in BYTE.

BYTE reader Robert N. Barrett, Vice President Management Information Systems, M/A-COM, Inc.

It doesn't get any better than BYTE.
Stacking Up TCP/IP

The BYTE Reprint Department will provide free quotations for reprints of BYTE articles. Reprints can serve as high quality, inexpensive promotional tools:

- Train and educate key personnel
- Present information at conferences/seminars
- Provide literature to users of your products

Call 603-924-2525 for information and a free price quotation.

Minimum order: 500

---

Super-TCP and Super-NFS Client

Super-TCP provides the basic TCP/IP utilities, including a Telnet with VT-220, VT-100, VT-102, or 3270 terminal emulation, talk, and smtp. You also get a network printing utility and an SNMP agent.

Super-TCP’s ftp utility works with FTP connections, enabling you to copy or move files between systems.

The separate Super-NFS Client product allows you to mount the Unix host’s file systems from your PC. You can mount NFS drives from DOS or Windows; Frontier Technologies recommends that you use File Manager to do the mounting. Remote mounts aren’t quite automatic; Super-NFS doesn’t support the Browse option in the Connect Network Drive dialog box, and you must remember to unmount your network drives while still in Windows or Windows will crash on exit. The TCP/IP DLL doesn’t support domain name resolution.

You can configure Super-TCP as a TSR or a DLL. The TSR component took 56 KB of RAM in the NDIS token-ring environment that I have. The DLL version takes up no pre-Windows DOS memory. Super-TCP works with network adapters that come with NDIS drivers or packet drivers, and Super-TCP offers SLIP access.

The reference manual is adequate but not as useful as that of the NetManager. I was surprised that the printed documentation didn’t warn me, for example, about Super-TCP’s copy-protection scheme. Since protection keys weren’t mentioned in the manual and were only listed in a readme file, I had some trouble installing Super-TCP. Once the security and documentation problems were ironed out, however, it worked fine.

Chameleon NFS

NetManage includes a unique and very useful feature in Chameleon NFS—the ability to configure your PC as an NFS server. This means that you can share files and printers PC-to-PC, without having to connect a Unix host to the LAN. You only see remote files; they can’t mount and then access remote drives as if they were locally attached.

Beame & Whiteside supplies a substantial reference manual with BW-NFS 3.0. The manual needs an index, but otherwise it’s complete, accurate, and easy to follow.

---

Super-TCP Messages

Screen 2: Super-TCP provides useful network statistics, including IP addresses, IP routes, and ARP information.

---

The BYTE Reprint Department will provide free quotations for reprints of BYTE articles. Reprints can serve as high quality, inexpensive promotional tools:

- Train and educate key personnel
- Present information at conferences/seminars
- Provide literature to users of your products

Call 603-924-2525 for information and a free price quotation.

Minimum order: 500

---

Super-TCP and Super-NFS Client

Super-TCP provides the basic TCP/IP utilities, including a Telnet with VT-220, VT-100, VT-102, or 3270 terminal emulation, talk, and smtp. You also get a network printing utility and an SNMP agent.

Super-TCP’s ftp utility supports drag-and-drop direct manipulations with the mouse (see screen 1). You can, for example, copy a host file to your local hard drive by dragging a file icon from one window to another.

I wasn’t able to send or receive mail with the BW-NFS software because Beame & Whiteside hadn’t finished developing the mail software yet. When it’s completed, you’ll need to send in your product registration card to obtain the E-mail component.

You can mount or unmount NFS drives in File Manager’s Connect Network Drive dialog box, or you can issue a command-line mount command before you start Windows. A Windows background program, inetd, services requests made to your computer by other network users. You can configure the services to which inetd should respond (options include ftp, telnet, finger, and smtp). For each authorized request that inetd receives, inetd spawns a server task on your computer.

You use the Windows-based admin utility for maintaining the Beame & Whiteside Telnet and FTP password files that allow or deny other users access to your PC. The inetd program provides almost the capability of Chameleon NFS’s NFS server function.

However, inetd doesn’t quite deliver the peer-to-peer capabilities of Chameleon NFS. Clients of the inetd system can only see remote files; they can’t mount and then access remote drives as if they were locally attached.

Beame & Whiteside supplies a substantial reference manual with BW-NFS 3.0. The manual needs an index, but otherwise it’s complete, accurate, and easy to follow.

---

Super-TCP and Super-NFS Client

Super-TCP provides the basic TCP/IP utilities, including a Telnet with VT-220, VT-100, VT-102, or 3270 terminal emulation, talk, and smtp. You also get a network printing utility and an SNMP agent.

Super-TCP’s ftp utility supports drag-and-drop direct manipulations with the mouse (see screen 1). You can, for example, copy a host file to your local hard drive by dragging a file icon from one window to another.

I wasn’t able to send or receive mail with the BW-NFS software because Beame & Whiteside hadn’t finished developing the mail software yet. When it’s completed, you’ll need to send in your product registration card to obtain the E-mail component.

You can mount or unmount NFS drives in File Manager’s Connect Network Drive dialog box, or you can issue a command-line mount command before you start Windows. A Windows background program, inetd, services requests made to your computer by other network users. You can configure the services to which inetd should respond (options include ftp, telnet, finger, and smtp). For each authorized request that inetd receives, inetd spawns a server task on your computer.

You use the Windows-based admin utility for maintaining the Beame & Whiteside Telnet and FTP password files that allow or deny other users access to your PC. The inetd program provides almost the capability of Chameleon NFS’s NFS server function.

However, inetd doesn’t quite deliver the peer-to-peer capabilities of Chameleon NFS. Clients of the inetd system can only see remote files; they can’t mount and then access remote drives as if they were locally attached.

Beame & Whiteside supplies a substantial reference manual with BW-NFS 3.0. The manual needs an index, but otherwise it’s complete, accurate, and easy to follow.

Super-TCP and Super-NFS Client

Super-TCP provides the basic TCP/IP utilities, including a Telnet with VT-220, VT-100, VT-102, or 3270 terminal emulation, talk, and smtp. You also get a network printing utility and an SNMP agent.

Super-TCP’s ftp utility supports drag-and-drop direct manipulations with the mouse (see screen 1). You can, for example, copy a host file to your local hard drive by dragging a file icon from one window to another.

I wasn’t able to send or receive mail with the BW-NFS software because Beame & Whiteside hadn’t finished developing the mail software yet. When it’s completed, you’ll need to send in your product registration card to obtain the E-mail component.

You can mount or unmount NFS drives in File Manager’s Connect Network Drive dialog box, or you can issue a command-line mount command before you start Windows. A Windows background program, inetd, services requests made to your computer by other network users. You can configure the services to which inetd should respond (options include ftp, telnet, finger, and smtp). For each authorized request that inetd receives, inetd spawns a server task on your computer.

You use the Windows-based admin utility for maintaining the Beame & Whiteside Telnet and FTP password files that allow or deny other users access to your PC. The inetd program provides almost the capability of Chameleon NFS’s NFS server function.

However, inetd doesn’t quite deliver the peer-to-peer capabilities of Chameleon NFS. Clients of the inetd system can only see remote files; they can’t mount and then access remote drives as if they were locally attached.

Beame & Whiteside supplies a substantial reference manual with BW-NFS 3.0. The manual needs an index, but otherwise it’s complete, accurate, and easy to follow.
The New Model 24SII DES data exchange system is printer sharing at its best. Now network workstations, PCs can off-load print jobs at the blazing rate of 60,000cps parallel or 46,000cps serial.

If you want to eliminate the need for multiple laser printers without losing productivity, off-load network print jobs faster, or increase your print-throughput, the Model 24SII DES is for you.

Contact a BayTech representative today for more information on the best printer sharing solutions available.

- Expandable from 4 to 24 ports
- Compatible with Windows®
- Computer-to-computer communication for file transfer or modem sharing
- Up to 16MB buffer
- 1 year warranty

Because Resources Should Be Shared

BayTech

Data Communications Products Division
200 N. 2nd St. P.O. Box 387, Bay St. Louis, MS 38920
Fax: 601-467-4551 Phone: 601-467-8231 or toll-free
800-523-2702

Screen 3: Like the ftp screen presented here, many utilities in ChameleonNFS are surprisingly easy to use.

might use this feature to set up a kind of Unix-oriented peer network. The NFS server function worked well; I was even able to mount and access a PC's drive from a Unix client.

ChameleonNFS offers telnet (3270, ANSI, VT-52, VT-100, and VT-220 terminal emulation) and mail (SMTP and POP), in addition to the common utilities. ChameleonNFS also gives you bind (which provides Domain Name Server functions) and an SNMP agent.

NetManage's NFS implementation is the strongest of the three packages. In addition to the Windows-hosted NFS server capability, ChameleonNFS supports the mounting or unmounting of network drives from within File Manager's Network Connections dialog box. When you click on the Browse button, ChameleonNFS shows you the available (exported) remote host names and directories. You click on the host name and directory to mount, enter the DOS drive letter by which you want to refer to the host's drive, and click on Connect to complete the mounting and drive-letter mapping.

If you forget to unmount a drive before you exit Windows, Windows will sometimes crash (but not always). When you do have a problem, you'll find ChameleonNFS's help files the most complete and understandable of the lot.

The ChameleonNFS utilities are well designed and make good use of both Windows and NFS. You get easy-to-use listbox and push-button access to local and remote files, and the ftp utility supports a variety of host file-system types—for example, Unix, SunOS, and others—for filenames and other directory information (see screen 3).

ChameleonNFS works only with NDIS, although it offers SLIP access through a modem. Memory-wise, ChameleonNFS uses 6 KB of RAM for the base network driver. The rest of its functionality is in a Windows DLL.

You can use ChameleonNFS with NetWare if you also buy the separate IPX/Link product from NetManage. This lets you switch between ChameleonNFS and NetWare dynamically, without leaving Windows, with the MultiLAN driver.

Top TCP
I really liked NetManage's ChameleonNFS. The Windows utilities are easy to use, unique features like NFS host capability are extremely powerful, and I didn't even mind NetManage's approach to license-violation detection. The product is very well done.

BW-NFS is a close second, and worth a look if you are extremely price-sensitive.

It's complete (I assume that the mail product will be forthcoming) and well documented.

Barry Nance, a programmer for the past 20 years, resides in Wethersfield, Connecticut. He is a BYTE contributing editor and the author of Using OS/2 2.0 (Que, 1992), Network Programming in C (Que, 1990), and Introduction to Networking (Que, 1992). He is the Exchange Editor for the IBM Exchange on BIX, where you can reach him as "barryn."
Correspondence That Looks Good Globally

BIRRELL WALSH

In a global market, conducting business often involves corresponding in a variety of languages. But how do you write a letter in Urdu or draft a contract in Armenian? Gamma Productions addresses these needs with Multi-Lingual Scholar, a DOS-based word processor with fonts for 63 languages and a variety of alphabets.

MLS doesn’t translate languages; you need to know the languages or have a script. But it does provide tools for composing, importing and exporting text, creating and customizing fonts, formatting, and configuring printer fonts in almost any horizontally written script.

The benefits to using the program are documents that are correctly formatted in different alphabets, with sophisticated fonts, and free of penciled-in diacritical marks. I first learned about MLS when I needed to include passages of Greek, Hebrew, and Sanskrit in the same document. Was able to switch smoothly between languages with a few keystrokes. Each character set is so well implemented it was as if I were working in a dedicated word processor for that language. To my knowledge, it is the only program available for writing in many rare tongues.

The price you pay is that you must negotiate a nonstandard graphical interface. You must learn the program’s way of implementing style sheets. You must also master the setup process if you want to use an unusual configuration.

Who can benefit most from MLS? Primarily business, government, and academia. Most of the languages MLS provides are modern, like Thai and Hindi, but it offers some ancient ones like Syriac (although a typical businessperson won’t usually need to write in an ancient language). If you have staff a person literate in those languages, you’ll be able to produce good-looking business documents in MLS.

If you are doing business with a foreign country, you’ll need to work with governments, and some governments might also be using MLS. The Canadian government, for example, bought the program to write in Inuktitut, an Eskimo language with its own alphabet. Voice of America uses MLS for its field correspondents, and the BBC uses it in London for its foreign-language journalists.

Alphabets from A to Z

In addition to the English alphabet, the basic package includes the Arabic/Persian, Greek, Cyrillic, and Hebrew alphabets. With these, and by purchasing additional fonts (beginning at $50) from Gamma Productions, you can write in more than 60 languages, including Arabic, Croatian, the International Phonetic Alphabet, Russian, Thai, Urdu, and Yiddish. All the fonts I have seen are handsome when laser-printed and are suitable for camera-ready copy.

When you first start a document, the languages available are listed in the style menu. When you are writing in English, MLS functions like a traditional word processor. When you switch to another language, the program loads a new screen font and a new keyboard map. Style sheets can include language choice as well as formatting commands, so you can load a new language, style, and font with three keystrokes. When you print your document, MLS downloads the fonts. I find it easy to work in two or three languages in one document. The only problem is learning where the keys for characters are located.

Almost every language in the Latin alphabet includes unique characters, accents, or diacritical marks not found in most American-born word processors. MLS has them all, in addition to its non-Latin alphabets. Third-party foreign language fonts designed for Windows or for WordPerfect and other word processors may be fine for writing in one language at a time, but if you need to switch back and forth between languages, MLS handles the details beautifully.

You can have up to 10 working languages in one document and 16 fonts per page. When you switch between languages, all the rules switch as well. For example, if you embed Hebrew in an English document, MLS knows the Hebrew text is written from right to left. If the Hebrew is contained within an English paragraph, the Hebrew flows from right to left but the rest of the text remains aligned to the left. You can also override the automatic formatting.

In many languages, the placement of vowels and accents varies depending on surrounding consonants. Placement in reference to the baseline varies as well. In Hebrew, Arabic, and Hindi/Sanskrit, vowels may occur above, below, after, and even before consonants they follow in speech. MLS treats these vowels as overstrikes assigned to function keys or as specific character pairs assigned to one key.

MLS manages other features that have no equivalent in European languages. For instance, in Arabic and Hebrew, some letters have different forms depending on whether they’re initial, final, stand-alone, or embedded. MLS checks for the position of the letter and chooses the appropriate character form. MLS also handles “kashideh” justification. Whereas most
Western languages justify text by adding space between letters and words, Arabic and some North Indian alphabets justify with extended lines within words. Exemplifying this technique are the long loops of Arabic or the overhead lines from which Indian languages hang their characters.

**Conduct and Customize**

The base package of MLS comes with a number of keyboard maps for Latin-alphabet languages, including American, British, German, French, Spanish, and Italian. Cyrillic, Hebrew, Greek, and Arabic come with standard national typewriter layouts as well as layouts mapping English letters to close phonetic equivalents. You get two extra font disks of your choice with the package, and another one free when you send in your completed tutorial.

I tested MLS on a 33-MHz 386 system with 4 MB of RAM. Part of the process included editing blocks of several languages, often within one paragraph, including fifth-century B.C. Sanskrit and Hebrew, and Greek from a thousand years later. The program maintained correct formatting for each language. Then I printed the blocks on a Hewlett-Packard LaserJet II, which produced accurate results. Texts were also exported from MLS as PCX files. You can export the image files into Microsoft Windows Paint and further enhance them, as I did to make large signs.

**Flexible Design**

MLS helps you convert any language or script into any other. For instance, you can use texts that have been created by the University of Pennsylvania’s Center for Computer Analysis of Texts, even though their formats differ from those of MLS files. Let’s say you want to import portions of a CCAT Greek New Testament text. You’ll need to use the Configurable Text Interchange Utility that Gamma Productions bundles with MLS. You can configure CTIU to convert any text string to any other text string. You can also employ it to design any conversion—including formatting codes—that can be coded into 8-bit bytes.

Every feature of MLS is designed to be redesigned. You can customize the fonts, rules, and formatting to almost any degree you wish. If Gamma doesn’t sell the language you want, you can build a font for it with Font Scholar, a program for creating fonts that’s also included with MLS.

To build a font, you can either use Font Scholar’s graphics tools or scan in an alphabet and attach characters to keys with a keyboard map. Either way, it takes time to build a font. You can also define the rules governing the language: text flow from right to left or left to right, contextual character forms, type of microjustification, and import/export conversion codes.

**Almost WYSIWYG, Almost Universal**

If all these features seem too wonderful to be true, be aware that there are some shortcomings to the current version of MLS. One is the inability to work in either Chinese or Japanese. Both languages are often written vertically, and both use thousands of ideographs rather than a phonetic alphabet. The myriad characters cannot be encoded adequately in the 256 possibilities of an 8-bit byte (see "In the Land of the Double Byte," October 1992 BYTE).

Another drawback is that the MLS interface is poised about midway between early-1980s word processors and today’s desktop publishing packages. What you see is almost what you get. Columns do not appear on the screen, but typefaces and styles are shown. Also, MLS’s interface is an island unto itself in a world that is increasingly standardizing on Windows. However, MLS lets you create style sheets that include language choice as well as font, type attribute, justification, line spacing, and indentation.

The program gives so much that you want it to give more. Many of the languages are found nowhere else; in these cases, you would need to use MLS as a desktop publisher, perhaps to publish a catalog in five Indian languages to reach the subcontinent’s huge market. But in this version, you would have to paste graphics in by hand.

Fortunately, Gamma Productions is working on a Windows version, to be called UniVerse, scheduled for release early this year. The Windows version will support embedded graphics and vertically written languages. Gamma Productions is also promising to support Unicode. Unicode is a proposed 2-byte standard; 65,536 possibilities will allow encoding of all the major world languages, including Chinese and Japanese. With Unicode compliance, the infrastructure to build character sets for Chinese and Japanese will be in place, but Gamma Productions is not expecting to release these character sets before late 1995, when a scalable font of many thousand Japanese characters may be ready for publication.

Gamma Productions is also shifting its focus from bit-mapped to scalable fonts. Current bit-mapped fonts will continue to work, but so will TrueType and Adobe Type 1 fonts. Font Scholar, which produces only bit-mapped fonts, may no longer be bundled with MLS. The company is also devising a licensing system for developing Unicode-compliant software (before Unicode compliance becomes universal in Windows NT). A Macintosh version is also in the works for late 1993.

Multi-Lingual Scholar 4.01 for DOS is a very good word processor if you need to work in one or more of the supported alphabets. Scholars and businesspeople will have no trouble creating multilanguage documents. If you need to develop your own font for a language not usually supported by word processors, MLS is an extraordinary bargain.
Retooling a Classic

TOM THOMPSON

This issue introduces version 2.0 of the BYTE Lab's low-level Macintosh benchmarks (see "New Tricks for Slow Macs" on page 198). The Macintosh low-levels, like their DOS counterparts, evaluate video, disk I/O, CPU processing speed, and floating-point performance. The benchmarks consist of a suite of small applications, each of which exercises a particular subsystem. For example, to measure the Quadra 950's disk I/O performance, we launch the Disk Endurance test. I still remember a marathon we launched the next test application.

Our first Macintosh benchmarks—the first by a computer magazine testing lab—were written in July 1988; we used them to evaluate the Mac IIx. It's a tribute to good software design that the benchmarks survived several major revisions of the Mac OS and were used to measure the subsystems of the Mac IIvx, PowerBook Duo 230, and PowerBook 180.

Having said that, I also have to admit that we had to log test results by hand. Problems cropped up when Apple began introducing new computers in batches. Benchmarking one or two new Macs was easy, but testing five or six Macs at once and manually logging the results was an endurance test. I still remember a marathon session at Apple lasting over 4 hours during which Bruce Gee, the PowerBook product manager, helped me run the low-level tests on the then-new Mac PowerBooks, Quadras, and Classic II. Thus, out of necessity, the new tests were born.

The applications were originally created using a Small-C cross compiler written at BYTE that ran on a PC. We'd write Small-C code on the PC, and it would generate a file of 68000 assembly language instructions. This file would be copied to the Mac and assembled into a stand-alone application using Consultant's Macintosh Development System assembler. We chose Small-C as the code generator because it avoided a controversy raging at the time regarding how various compilers optimized benchmark code. Because Small-C didn't, it made the issue moot. To use Mac Toolbox traps, we wrote in-line assembly language glue code, since Small-C written for CP/M by Jim Hendrix—had no idea what a Mac was, much less how to create calls for the Mac OS.

We then set our sights on producing the latest version of our Macintosh benchmarks. Since the old test code was still proving its worth (it detected the floating-point performance boost of Omega SANE in System 7.0.1 and also detected that the Mac IIvx used a 16-MHz bus), we planned to reuse as much existing code as possible. The real design priorities became to produce crash-free code and make the tests easier to run. Dealing with these demands meant abandoning the Small-C cross compiler. First, it was out of date, and second, putting a friendly interface on the benchmarks required using lots of Toolbox calls. I chose Think C for the job because it's small and fast as Mac development tools go, it provides comprehensive Toolbox access, and it supports the use of in-line assembly language and assembly language instructions. I also had a proven application code skeleton written in Think C.

Of course, the job wasn't as simple as it sounds. There were the usual headaches revising the Small-C code, which used ancient header files, to conform with Think C's header files. The assembly language sections—especially the SANE macros for the floating-point benchmark—required some work too. Missing a small detail here caused all sorts of crashes. To get the first benchmark to operate, I had to go into hack mode and walk through the code instruction by instruction in a low-level debugger while watching the registers and stack to isolate the problem. Jasik Design's The Debugger was handy when I rooted out trouble at this level. Once I had discovered that Small-C passed function arguments on the stack the reverse from the way Think C did, it took little time to get the first benchmark—quickly followed by the others—in operation.

The final design of the new benchmarks is that of a single application that runs and times the tests. You can run all the benchmarks (the default), a suite of tests (e.g., the video I/O), or a mix of tests. Results are displayed in a window, or you can save them as a log file on disk. Because most tests dropped into assembly language code, many of the times are close to the version 1.0 times. The exceptions are the Sort, Sieve, and TextEdit, whose results changed because they were written entirely in C.

Now, testing a Mac just requires that you launch one application, make a menu selection, and let the program do the rest. Will these benchmarks hold up as long as the originals? Perhaps. But with Apple releasing more and more Macs, and the PowerPC coming down the pike, I expect I might have to work on them again in the near future.

Tom Thompson is a BYTE senior technical editor at large with a B.S.E.E. from Memphis State University. He is an associate Apple developer. You can reach him on BIX as "tom thompson," on AppleLink as "T.THOMPSON," or on the Internet at tomt@bytepb.byte.com.
BOOK
AND CD-ROM REVIEWS

HUGH KENNER

Only last July, this space was shared between Hard Drive, all about Bill Gates, and Accidental Empires, in which Gates’s Microsoft, IBM, and Gates himself ranked 1, 2, 3 in length of index entries. So why another Gates book so soon? Chiefly because it gets us past the Hard Drive fixation on temper tantrums and dandruff. If Bill Gates merits more than tabloid attention, it’s because he helped reinvent the desktop computer industry, a feat that Manes and Andrews understand as their Hard Drive precursors never quite did.

ROM and RAM, bit and byte, DOS in numerous flavors or GUI, interpreted BASIC or compiled—the current that gives meaning to Chairman Bill’s life has streamed past and around such markers. From about the middle of their long book, Manes and Andrews help us sense the force and purpose of that current, as it drives interactions with IBM, with Apple, with a calculated future.

Knowing what jargon words mean, they’ve been able to talk profitably with more than 300 sources. That’s something you can do only if your source senses there’s a language in common; otherwise, you’ll pick up just what it’s easiest for the source to brush you off with—namely, gossip. About half the informants “gave us hours of their time—a full workday in more than one case.” The rest granted access by phone for up to an entire evening. All that solid information does show.

Something else, and our authors well know how this can be tricky: Bill Gates himself granted interviews, hours of them. As one of their contacts asks, “Is this an authorized biography or an honest one?” An afterward, some 3000 words called “Full Disclosure,” addresses that topic in such detail did it not make starkly plain the suspicious and litigious climate in which elucidation must send forth its shoots. Not the least suspicious party is apt to be someone like you or me, wondering about bribes and PR.

Anyone interested in the multimillion-dollar phenomenon called Windows, and why it was years getting shaped into anything usable, and what were the details, meanwhile, of Microsoft’s frenzied interactions with Apple and IBM, need look no further than this book. If we’re stuck with Windows, seemingly, the way we’re stuck with the QWERTY keyboard, how that came about still makes an engaging narrative.

Hugh Kenner is Franklin and Callaway Professor of English at the University of Georgia. His recent books include Mazes and Historical Fictions. You can contact him on BIX as “hkenner.”

THE INFINITELY SMALL

Nanosystems: Molecular Machinery, Manufacturing, and Computation,

Imagine a world of manufactured devices so small that the designer must specify the order and arrangement of atoms in the finished machines. Consider systems so finely tuned that their operation is performed through the making and breaking of single chemical bonds.

Creating such worlds has been the decade-long quest of K. Eric Drexler, president of the Foresight Institute. His latest work, Nanosystems: Molecular Machinery, Manufacturing, and Computation, is a scholarly review of the physical and chemical concepts that may one day enable the production of desktop nano molecular devices.

Drexler’s book is a return to first principles—the design of levers, ratchets, gears, springs, and pistons. Except, at the nano level, we now need to be concerned about the stiffness and tensile strength between individual molecules. Once the basics are understood, you can move on to the complex machines, such as a six-legged tool positioner composed of 3 million atoms and able to move approximately 100 nanometers. My favorite chapter describes the design of basic logic gates for a mechanical computer. The book includes the design of a finite-state machine theoretically capable of reaching over 1000 MIPS.

Nanosystems is not a light romp through the world of the future. It is a scholarly examination of how this technology works, a reference book for the crafters of the future.

—Raymond GA Côte
Controversial Windows


Few trade books have inspired such a swirl of controversy. When Undocumented Windows appeared last fall, Microsoft bashers pounced eagerly on passages that showed how Microsoft’s tools and applications exploit undocumented Windows APIs and data structures. Microsoft, under FTC scrutiny for such practices, retaliated with a massive press release describing documented alternatives to these APIs and data structures. The company further claimed that its programmers gained nothing by their use of undocumented features and even, in some cases, suffered for their backdoor tricks. This perverse argument provoked Schulman to dig up more evidence—far more damning than what’s actually in Undocumented Windows—that Microsoft’s applications programmers do profit by their special knowledge of Windows internals.

This juicy scandal has undoubtedly spurred sales, but that is hardly a reason to buy the book. Read it, instead, for its remarkable insights into the architecture of Windows and the nature of Windows programming. The conventional view is that Windows is—and should be—a set of mysterious data structures wrapped in an enigmatic function-call interface. While such information hiding can be useful, there are also good reasons to know something about the real objects (e.g., window structures and device contexts) that lie behind the veil (e.g., HWNDs and HDCs).

The discovery of these secrets took a large amount of detective work. Using commercial debuggers and disassemblers, along with an impressive collection of home-grown tools (including on the accompanying disk), the authors patiently strip away Windows’ veneer of mystery to reveal a complex, sometimes wacky, but ultimately coherent work of software engineering. Some of the undocumented functions they unearth will be of general use to Windows programmers. For example, IsWinOldApTask distinguishes between DOS and Windows tasks. Other undocumented functions, like the infamous TabTheTextOutForWimps, are included just for completeness.

Although it’s packed with dense technical detail, the book is a surprisingly good read. The rocket science is leavened with a healthy dose of humor. On WinWord’s mishandling of the idle interrupt: “Where’s a decent monopoly when you need one?” On event-driven programming: “Only the size of the manuals has changed...It’s really just good old interrupt handling in yuppie attire.” Like its predecessor Undocumented DOS, Undocumented Windows is an instant classic.

—Jon Udell

Ode to Oberon


Oberon is Niklaus Wirth’s latest programming language, the successor to Modula-2, which in turn succeeded Pascal. Wirth quotes another famous Swiss, Albert Einstein, in pronouncing Oberon “as simple as possible but not simpler.” This book is a tutorial and language reference for Oberon and its elegant GUI operating system. The style is lucid and authoritative, and the programming examples are not the familiar 10-line clichés, but weighty topics like a discrete-event simulation and the Oberon graphics editor.

Throughout the text, Reiser and Wirth draw attention to questions of program correctness and proof, but without introducing too many unreadable formalisms. Chapter 12, “Object-Orientation,” offers the best, most jargon-free overview of what OOP (object-oriented programming) really involves that I’ve read anywhere. It contrasts two possible OOP approaches in Oberon, using type extensions with methods implemented as either procedure variables or handlers. Wirth has mellowed his previous skepticism toward OOP and describes Oberon-2, an upwardly compatible extension that provides a true class mechanism via type-bound procedures, with a syntax not unlike Object Pascal.

Next time swatting the bugs in your C++ project gets you down, buy this book for a glimpse of a better world.

—Dick Fountain
NDP™ Fortran Drives Them All...

Extended DOS • OS/2 • NT • UNIX V.3/4 • Solaris • Coherent

NDP Fortran has been the leading 32-bit PC Fortran since its introduction in 1987. It produces the highest quality numeric code and supports virtually all x86 operating systems, processors and numeric devices. These are just a few of the reasons it was used by hundreds of ISVs to port their 3090, VAX and Cray codes to the 386. NDP Fortran is required to run packages from IBM, Aspen Technologies and Fluid Dynamics. IBM chose it to port their Optimization Subroutine Library to DOS and more recently OS/2. Aspen Plus, the world’s leading thermo/chemical-process control software package, is the standard employed by corporations like DuPont. Every copy of Aspen Plus for the PC ships with NDP Fortran-486!

One reason NDP Fortran is still the 32-bit leader is tools. It runs with native tools on UNIX, OS/2 and NT. For DOS, Microway created 32-bit tools that were tuned to the needs of our customers. These include efficient demand paged virtual memory for our Extender and a linker that could handle a 20-megabyte library without going to sleep. We are the only vendor that provides a variety of numeric runtime libraries that make it possible to tune speed against precision and error recovery. The correct choice of a library vs inline intrinsics can result in a factor of three increase in speed for some applications. Then there is the issue of numeric code quality. NDP compilers are not only globally optimized, but take good advantage of the Intel 387/487 stack, use advanced numeric optimizations and schedule instructions - all of which favor fast numeric and RISC devices like the 860 and 586.

Finally, Microway customizes its compilers to the environment. Our DOS 386/486 product includes over 1,000 pages of documentation, 300 of which are devoted to our GREX™ graphics extensions. The 200 megaflops of our QuadPuter-860 are optimally harnessed using NDP Fortran-860, libraries from IMSL, NAG and KAP and the PSR Vectorizer. Microway can build you a gigaflop NFS computational server using five QuadPuters housed in our industrial grade 486-B for just $50K - massive power without massive price. If you plan to use a 386, 486, 586 or 860 and require portability, numeric speed, precision and technical support, then NDP Fortran, C++ or Pascal is the only solution.

Please call our UK office to register for NDP ’93 - Microway’s i860 and Compiler Products Seminar in London on Feb. 17, 1993.

Microway

Corporate Headquarters, Research Park, Box 79, Kingston, MA 02364 USA • TEL 508-746-7341 • FAX 508-746-4678
Kingston-Upon-Thames, U.K. 081-541-5466 • Germany 069-752023 • Greece 30 12915672 • Japan 047 423 1322 • Poland 22-410041

Technology You Can Count On

Circle 102 on Inquiry Card.
QuickTime is Apple's multimedia software standard. A hardware-independent extension to the Mac OS, QuickTime integrates time-based dynamic data types, such as sound, video, and animation, into applications as digital movies. As this term implies, QuickTime manages events that happen over time in much the same way that QuickDraw manages still images. Just as PICT graphics enhance presentations, QuickTime movies add a new dimension to communications, presentations, simulations, and decision-support applications.

In addition to being the foundation developers use for creating multimedia applications on the Mac, QuickTime gives users a standard way to display, compress, copy, and paste time-based data. QuickTime follows Apple's philosophy that such data should be incorporated as a standard data type and you shouldn't have to be a multimedia professional to create multimedia documents. QuickTime is hardware independent, which allows for the development of QuickTime software for non-Mac computers. Apple began shipping a version of QuickTime for Microsoft Windows as this article went to press.

The QuickTime Architecture

QuickTime consists of four major components: system software, file formats, Apple compressors/decompressors (called codecs), and human-interface standards and utilities (see figure 1). The system software has three subcomponents: the Movie Toolbox, for the creating, editing, and playback of movies; the Image Compression Manager, or ICM; and the Component Manager. We'll discuss these three components in detail later.

A movie is a container for all types of dynamic data. It can be used for such things as a presentation slide show, an animated bar chart, a montage of images and sounds, or a dynamic graph of laboratory data. Movies contain references to groups of homogeneous data, such as video or sound, that are organized into tracks (see figure 2). Tracks don't contain the data, but instead reference actual data files on videotape, disk, and other media. QuickTime synchronizes these tracks when it plays a movie.

The movie file format emulates big-screen movies by including provisions for posters (i.e., still frames that represent the movie for printing) and previews (i.e., short clips that represent the movie when previewing). Because a movie file contains references to only its media data, it's small enough to put onto the scrap, which is the data container that the Mac Clipboard and Scrapbook use.

Apple has extended the PICT file format to allow for compression and previewing. Users can compress a still image using any compression scheme registered with the Component Manager and decompress a still image.

ILLUSTRATION: LYNN BOYER-PENNINGTON © 1993
QuickTime provides a consistent way of controlling, copying, and pasting movie segments. Movies, Tracks, and Media

Time is a fundamental concept in QuickTime movies. Every movie has a time scale, a time base, and a time-coordinate system. The time scale defines the unit of measure and the movie's duration. The time base is the current value of time along with a vector that defines the direction (forward or backward) and velocity of time (the current value of time is meaningless until the time scale is specified). The time-base value is extracted from the time-coordinate system, which essentially comprises the x, y axis on which the time-base vector is plotted.

Each track defines a separate set of data that can be interpreted within the movie's time-coordinate system. All tracks begin at the start of the movie, but not all of them contain data initially. Even those that do contain data won't play unless they are activated (see figure 2). QuickTime movies may have one or more tracks active simultaneously.

When you're editing a movie file, you define a segment by specifying a start time and a duration. Two elements define a movie's display characteristics: the movie source clipping region, which defines the portion of the source image that's visible, and the 3-by-3 transformation matrix, which determines how the image will be rotated and scaled. The Movie Toolbox uses these elements to determine spatial characteristics, and it provides routines that let you work with movie or track characteristics, such as the volume setting and playback rate. The Movie Toolbox also lets each application store its own user data along with a movie.

A track is a private data structure with its own control information. Each track represents a single stream of data and refers to a single medium, or file, that contains movie data. A track contains a list of references, called an edit list, that defines the portions of the medium used. Consequently, a track can play the media data in any order, for any number of repetitions. Each entry in the edit list includes the starting time and duration of a track segment, along with the playback rate for that segment. The actual data may reside on a CD-ROM disc, a hard disk, videotape, or other medium.

A movie can contain more than one track of a given type. This is handy if you want to create a movie with sound tracks in different languages. You manage these tracks by assigning them to alternate groups and making one active at a time.

A QuickTime track's display characteristics are specified by the image size, a transformation matrix, and a clipping region. Each track also has a volume setting for sound.

The medium contains a track's data and information that identifies its language and quality. Each storage medium has its own time scale and duration, so any time values that relate to a given medium must be defined within the medium's parameters. A medium uses the time base of the movie that is using the medium's data, and the tracks map data from the medium's time system to the movie's time system. Each supported data type has a media handler that provides random access to the data and plays segments at rates that the movie specifies.

QuickTime movie tracks do not ordinarily contain movie data, but you can use the Movie Toolbox to create movie files that store the movie and all related data in the Mac data fork. This is useful for sharing QuickTime movies with computers that support QuickTime but don't support multifork files. QuickTime support is quickly moving beyond the Mac: Apple developed a QuickTime player for Windows, and Silicon Graphics has added QuickTime support to its applications.

The Movie Toolbox

At the heart of QuickTime is the Movie Toolbox. It includes scores of high-level routines that let you load, play, create, edit,
and store objects that contain time-based data.

The Movie Toolbox routines provide basic operations for opening and playing movies, as well as more complex routines for creating and manipulating the data that make up a movie's media types (i.e., sound, video, graphics, or animation). You initialize the Movie Toolbox by calling the Entermovies routine. Similarly, the Exitmovies routine cleans up after your application is finished.

Before an application can work with a movie, it must load the movie and then create a new movie file in which to work. The OpenmovieFile routine opens a movie file; NewmovieFromFile loads a movie. When you play a movie, the Movie Toolbox processes the movie's data based on its time-coordinate system. If the movie contains video data, the Movie Toolbox displays the resulting images in the display window you specify. If the movie contains audio data, the Movie Toolbox plays the sound track at a volume level that you set.

The ICM
Uncompressed image data requires a large amount of storage space. At 30 frames per second, a 10-second movie containing 640-by 480-pixel frames with 8-bit color requires nearly 100 MB of disk space. Consequently, minimizing the storage requirements (network and backbone bandwidth requirements) for image data is an important consideration for any application that works with images or sequences of images.

QuickTime's ICM provides applications with image compression and decompression services that are device- and algorithm-independent. Two points about the ICM are worth noting: Its architecture is open and handles many different kinds of algorithms, and it can read and perform compression schemes on the fly. The ICM also manages many display details, such as clipping, scaling, crossing screens, and fast dithering. In this way, the ICM enables all QuickTime-compatible software to use a common application interface for compression and decompression operations on images and sequences of images, and it allows an application to use images created with a different application.

The ICM invokes compressor components, code resources managed by the Component Manager that perform actual compression services (see figure 3). Applications communicate either directly with the ICM or indirectly via the Movie Toolbox, which passes requests to the Component Manager. The ICM does not maintain time information for an image sequence—the Movie Toolbox handles all timing considerations—but it does maintain the order and content of the images.

The compression algorithm used affects the compression ratio and speed, symmetry, and image quality (e.g., loss characteristics). Different applications make different compression trade-offs. QuickTime ships with three algorithms. The photo compressor implements the JPEG (Joint Photographic Experts Group) algorithm, which QuickTime uses for PICT images. The video compressor uses an Apple-designed algorithm that permits fast decompression times while maintaining reasonably good picture quality. The video compressor allows interactive display of 24-bit images; processes input video images at 8-bit, 16-bit, and 24-bit color depths; and supports both spatial and temporal compression. The animation compressor is based on an algorithm optimized for animation and computer-generated video data.

The ICM also lets you obtain information about compressed images or about the facilities available for image compression, select a specific compressor, and determine how much memory to allocate to receive a decompressed image. You can even display a compressed PICT file without performing any special processing. When installed on a system, the ICM creates a new StdPixGrafProc procedure, which handles all requests to display pictures. Whenever an application issues the standard DrawPicture function to display a picture that contains compressed image data, the StdPix procedure decompresses the image by invoking the ICM and delivers the decompressed image to the application.

The ICM uses PICT op codes to store the compressed picture's image description (i.e., its compression format and characteristics of the compressed image data), image data, transfer mode (srcCopy, ditherCopy, and so on), the accuracy with which the image should be decompressed, the matte pixel map, the mask region, the mapping matrix, and the source rectangle of the image. Masks and mattes control which pixels in the source image are drawn to the destination. Mattes provide a mechanism for mixing two images. Because the ICM stores the mask and matte images separately, you can apply different masks or mattes during decompression.

A QuickTime application might give the user the option to specify a compression algorithm that's based on performance characteristics such as size, speed, and accuracy. The ICM allows the application to choose the compressor component that meets the user's criteria. Many ICM functions accept special component identifiers that select the fastest or most accurate compression algorithm or the algorithm that produces the smallest compressed image from among those that are installed on a given system.

![Figure 2](image-url)

**Figure 2:** A QuickTime movie consists of multiple tracks that reference different data types on various media. Shown are five movie tracks, plus two preview tracks and a poster track. All tracks begin at the start of the movie, although the data does not always start at the beginning of a track. A track can end at any time, and QuickTime plays only those tracks that are active. Multiple tracks can be active at the same time.
The Component Manager

The Component Manager allows applications to find and use predefined classes of software objects at run time, and it enables external resources (e.g., digitizer cards) to register their capabilities with the system at run time (see figure 3). Before QuickTime, any applications developer who wanted to support digitizer cards had to write custom software for every device supported and change the software every time the hardware changed. With QuickTime's Component Manager, hardware is transparent to applications. The application merely makes a request to the Component Manager for a digitizer card with certain capabilities, and the Component Manager locates and communicates with components of that type. When you install a new QuickTime device, be it a frame grabber, video board, or DSP (digital signal processor) compression board, you just drop the QuickTime driver provided by the manufacturer into the Component Manager folder, and the new device operates transparently.

The Component Manager uses standard Toolbox routines to provide a database service that classifies software and hardware objects by function and allows applications to bind with functional objects at run time. It is designed to handle any kind of hardware or software module. Future modules that will be brought in via the Component Manager might include OCR (optical character recognition), color-matching schemes, and printing interfaces.

Given a particular function type, the Component Manager can locate and query all components of that type. The first step is to locate an appropriate component. The Component Manager does this with the high-level FindNextComponent routine. The Component Manager keeps track of many characteristics, including a name, an icon, and an information string for every component registered with the system. You can also find out how many components of a specific type are available and obtain additional details about a specific component's capabilities. Your application opens a connection to that component, and you can then use the component's services.

In this way, the Component Manager creates a level of abstraction between components and their client applications. Instead of implementing support for a particular data format, protocol, or model of a device, you can use a standard interface through which your application communicates with all components of a given type and use the Component Manager to locate and communicate with components of that type. For example, components of type 'imdc' provide image-decompression services. All the components of type 'imdc' share a common application interface, but each image-compression component may support a unique compression technique or take advantage of a special hardware implementation. Algorithm- or hardware-specific variations of the compression interface are implemented by each 'imdc' component.

The Sound Effect

QuickTime sends audio information to the Sound Manager, which then sends the data to the hardware. This is the path a digital audio track takes to get from your hard disk to your Mac's speaker. The Sound Manager is a collection of routines that allow applications to create, edit, and play sounds directly from the Macintosh speaker or through the output jack of the computer—but it is not a part of QuickTime. Apple plans a new Sound Manager (which will still be separate from QuickTime) that will support high-quality 16-bit stereo sound hardware in addition to the Mac's internal speaker.

Individual components in QuickTime may support additions to the defined application interface, as long as they support the common routines. If you're using commercially available hardware, such as video I/O boards, sound boards, DSP accelerator boards, or dedicated image compressors, you will find that most manufacturers have chosen to implement an Apple-provided component on their hardware. However, you (or your card manufacturer) may elect to create your own component. You might do so in order to create an entirely new function, such as a new filter for a desktop publishing package; to add multimedia capability to a paint/drawing package; or to modify a component (e.g., adding MPEG [Moving Pictures Experts Group] audio compression to an existing MPEG video-compression component).

The Component Manager allows a single component to serve multiple client applications simultaneously. Each client has a unique connection path to the component, which maintains separate status information for each open connection.

QuickTime Components

QuickTime components are software objects, overseen by the Component Manager, that provide a defined set of services to client applications. QuickTime ships with dozens of components, including compressor components; movie controller components, which let applications play movies using a standard user interface;
We made this ad the same way some people still do calculations.

Aside from the quarter million or so people who already use Mathcad®, most engineers and scientists continue to do calculations by hand. Using calculators and

scratch pads. Or jamming them into spreadsheets. Or pounding away at code on their keyboards.

Which is all quite unnecessary when you consider that Mathcad provides a faster, more natural, less error-prone alternative. Simply enter equations anywhere on the worksheet. Graph results in 2-D and 3-D. Change variables and instantly update answers. Add text to support your work.

And print presentation quality documents complete with text, graphics and equations in real math notation.

Mathcad comes with more than 200 commonly used functions built-in, including exponentials, differentials, cubic splines, FFTs and more. Full symbolic capabilities are available with a menu pick, so you can evaluate any integral, Taylor series or infinite sum just by clicking.

Optional Electronic Handbooks give you instant access to fully interactive formulas, diagams and data tables directly from popular reference books. Work with them right in the handbook itself. Or click and paste them for use in your Mathcad documents.

Plus optional Applications Packs with customizable templates are available for all major engineering and science fields.

So put down your pencil, pick up the phone and call now to get a free Mathcad Working Model and complete information. Or mail or fax the coupon below.

Once you get your hands on Mathcad, you'll never do math the same way again.

Call: 617-577-1017 Fax: 617-577-8829

1-800-MATHCAD

FREE Mathcad Working Model.

The Mathcad Working Model includes a concise demonstration and a fully functioning version of the product. It's the best way to introduce yourself to the power and ease of Mathcad.

FREE Mathcad Working Model:

SPECIFY:

☐ PC Windows™
☐ Macintosh®
☐ PC DOS/UNIX®
☐ 3½/5¼ Diskette

Mail to: MathSoft, Inc., 201 Broadway, Cambridge, MA 02139 USA Phone: 1-800-628-4223 • 617-577-1017 Fax: 617-577-8829

For information on Mathcad distributors outside of the U.S., contact Mathsoft USA © 1992 Mathsoft, Inc. TM and ® signify manufacturer's trademark or registered trademark respectively. Electronic Handbooks require Mathcad 3.1.

Circle 96 on Inquiry Card.
QuickTime: Hardware-Hungry

Few computer applications are as demanding as digital video. A QuickTime movie strains the capabilities of processors, memory, disks, video and audio circuitry, and the various pathways that join them, even on a Mac Quadra. Full-motion, full-screen, full-color video requires a data transfer rate of approximately 27 MBps. One minute of such a video requires over 1.5 GB of storage. To reduce storage requirements, QuickTime implements on-the-fly compression and is algorithm independent. However, many users may want to budget for an accelerator board.

For most users, software-decompressed video is limited to small windows and low frame rates. QuickTime 1.5 can play 8-bit, 160- by 120-pixel color movies at 24 to 30 frames per second, or 320- by 240-pixel images at 12 to 15 fps on a Mac LC II. The speedy Quadra 950 can play back 8-bit, 640- by 480-pixel color movies with monophonic sound at 24 fps—just short of the 30 fps required for full-motion video.

Working in a small image area is acceptable for augmenting spreadsheets and word documents with video and animation clips, but it is not appropriate for video-intensive multimedia applications that require larger images and faster frame rates.

Fortunately, QuickTime-compatible hardware tools are available for audio and video compression, frame grabbing, and acceleration of the video display.

Many boards include both NTSC and PAL inputs and outputs. Accelerator boards use dedicated chips, such as JPEG (Joint Photographic Experts Group) accelerator chips; RISC chips; and DSP (digital signal processor) chips. DSP chips are well suited for QuickTime acceleration because they can handle a variety of QuickTime tasks, including both audio and video compression as well as fax, modem, and telephony functions. Board prices range from $300 to $3000, depending on your needs (see “New Tricks for Slow Macs” on page 198). However, regular QuickTime users will find the investment worthwhile.

movie grabber components, which are data-handling routines that accept video and sound input and write data to QuickTime movies; clock components, which handle timing sources and information; previewer components, which allow applications to display preview information; and video digitizer components. Custom components may also be provided by hardware vendors.

The Component Manager classifies each of these components according to its type, the level of service it provides, and its manufacturer. It uses a four-character designator to identify the type of service a component provides (e.g., all image compressor components have a component type value of 'imco'). All components of a given type support a common application interface.

The Component Manager lets components identify the service level they provide by specifying a four-character component subtype value. An image compressor component uses the component subtype value to specify the compression algorithm that it supports. The component subtype value is meaningful only in the context of a given component type, and all components of a given type/subtype combination support a common application interface. However, components that share a type/subtype specification may support additional application routines that are not part of the basic interface.

Finally, the Component Manager allows components to have a four-character code (published by Apple Developer technical support) that identifies the manufacturer of the component.

QuickTime could become a de facto cross-platform standard.

Evolution in Progress
QuickTime is an evolving technology. Apple’s initial focus has been on bringing video to the desktop. Because video is resource intensive, Apple is continuing to improve software-decompressed video data rates. Most users, however, will want extra hardware to handle the burden (see the text box “QuickTime: Hardware-Hungry” above).

QuickTime still doesn’t handle all media data types. For example, it has no facility for dealing with SMPTE data tracks, a standard in the video-editing world that QuickTime must support before it can be used in professional video-editing systems. QuickTime also isn’t yet MIDI-aware and doesn’t support CD audio systems, although Apple plans to add support for both.

On the video front, Apple is working with Avid Technology (Tewksbury, MA), a marketer of Mac-based professional video-editing workstations. The companies plan to merge QuickTime with Avid’s Open Media Framework Interchange, Avid’s file format for digital media compositions, along with the underlying data for both.

QuickTime’s flexible architecture and hardware independence have earned respect from the Mac community. With support coming from Apple for Windows, and from third parties such as Silicon Graphics, QuickTime could take root as a de facto multiplatform multimedia standard for the 1990s.

Andrew W. Davis is an independent marketing consultant focusing on high-technology marketing communications and business development. His interests include data acquisition and image processing. Joe Burke is president and a founder of Spectral Innovations in Santa Clara, California. His interests include DSP. You can contact him on BIX c/o "editors."
Since standard C has no support for mouse and enhanced keyboard events, programmers working in character mode must use whatever facilities the operating system provides. MS-DOS conveys mouse events to your program by way of interrupts. Under OS/2, you might use a device monitor. Unix options include treating /dev/mouse as a stream, using ioctl calls, or exploiting signal events. In this article I'll present a C++ solution to the problem of handling mouse and keyboard events—a solution that's portable to DOS, OS/2, and Unix.

Event is a C++ class library I originally developed to handle input from the DOS keyboard and mouse. Over time, I've extended it to OS/2 and Unix as well. Much as with Windows or OS/2 Presentation Manager, Event allows the DOS programmer a single point of entry to monitor all standard messages. Thus, the class supports the development of event-driven programs. I'll demonstrate how to use the Event class, and I'll examine the key structures and class members that enable the class to do its job. I'll also discuss why C++ is uniquely suited to the development of portable, maintainable, reusable modules.

The Event Class
Since Event was originally built as a C++ wrapper around lower-level operating-system keyboard and mouse routines, it has been easy to port to other operating systems. By using the C++ ability to hide platform-specific functions and data behind a class interface, I've been able to ensure that my code never used functions that would not be available to it on another operating system. The code I'll present here comes from the DOS implementation of Event.

When dealing with multiple sources of input messages, it's crucial to serialize those messages. For example, while typing in a string, a user might decide to press a function key instead, or to click on a mouse button. The Event class takes a two-pronged approach to handling this problem. I've overloaded its central method, GetMessage, to support two modes of message retrieval. One fetches input events of all types: characters, function keys, and mouse events. The other fetches whole strings and preserves noncharacter events separately. To use the class, a program calls GetMessage, which returns results in a structure called MSG. Other member functions exported by the Event class enable the program to get and set the mouse and cursor locations.

There's no need to initialize Event's data structures in order to use it, or to clean them up when you're finished. Nor need you worry about device (e.g., mouse) setup. That's typical of C++, which provides class constructors and destructors for these purposes. Constructores and destructors can handle setup and shutdown chores required by the class or the operating system and make
these issues transparent to the programmer. This transparent handling of device and class initialization ensures that the time a program calls any members of the Event class, the method is primed and ready to do its job. In C++, class constructors and destructors carry the name of the class in which they are defined. As you can see in listing 1, the destructor carries a tilde in front of its name.

Constructive Coding
Because of the freedom from data and device initialization that class constructors and destructors provide, operating-system peculiarities used to control odd input devices (e.g., a mouse) can be safely tucked away inside class members. In DOS, this means that the command to turn on the mouse can be placed in the class constructor, while the chore of turning off the mouse is placed in the class destructor (see listing 2). Just declaring an instance of the Event class causes the constructor to run. When that instance goes out of scope, the destructor runs.

At its lowest level, Event merely loops through the various DOS device-monitoring interrupts, checking for input events—characters, function keys, and mouse-clicks. There are times, however, when you want more than a single message back from the keyboard—for instance, you might not want Event to return to you until it has read a string of a certain size. To deal with this requirement in standard C, you would quite naturally write another function to provide this new feature. The same is true in C++, but you get to reuse (overload) the function name. In the case of Event, I declared a primitive Message function

```c
DOSMSG
*GetMessage(char *, int);
```

and an alternative, string-building Message function

```c
DOSMSG *GetMessage(BOOL);
```

When you call Event::GetMessage (...), the compiler can determine which version to use only by inspecting the parameters specified in the call. Since the compiler can easily distinguish Event::GetMessage(BOOL) from Event::GetMessage(char *, int), there's no problem overloading the function.

Note that class constructors and destructors are always placed in the public portion of the class definition. If the prototypes for these two class members were placed in the private portion of the class instead, not even the C++ class initialization code would be able to call them. As their names imply, public members of a function or structure can be accessed by anyone able to create an instance of the class. Private and protected class members, however, can be accessed only by friend functions or other class members.

In standard C, you can get much of the effect of the C++ private or public statement by defining functions as static in separately compiled files. However, in C++, the class permits these functions and other class members to reside within the same file, if desired. This ability to refer to static functions in other files not only eases the chore of code maintenance by providing a map of how the class is to be used, but also allows for functions to be easily swapped between public and private views.

T

he C++ class can free your program from operating-system dependencies.

Unlike with static functions in C, when you move individual functions between visibility scopes in C++ you need only move the prototypes among the various sections of the class definition: private, protected, and public. You needn't change the functions themselves, which can reside physically in other files.

Having seen the advantage of function-name overloading and additional class-member scope classifications, you can see how the C++ class can free your program from operating-system dependencies. Strange and cryptic device-level interfaces can be hidden in the private portions of a class, initialized quietly by class constructors, and exported to the rest of the world through a public class member. The application programmer need only know which public class members are exported and how to use them. The ability to rigidly define how a programmer is to use your code is a critical part of providing yourself with a portable interface into other environments.

Certainly the ability to overload names and hide class members has the effect of making a program more portable. However, when individual function names can so easily be overloaded, you can also see how C++ programs can be easier to develop and maintain. When a C++ function is modified, old programs can still keep their original entry points. If newer functions can differentiate themselves from older versions by at least one parameter (admittedly sometimes tricky), then obsolete functions don't have to be replaced—just overloaded and modified to call the newer version of the function. For the most part, old source code can remain virtually untouched.

Although you can get the approximate effect of function-name overloading in C by moving, for example, the old function prototype into a #define macro that maps the old function name over to the new name, the C++ method just described better documents what is taking place. Furthermore, since the old function can be entirely rewritten to support the requirements of the newer version of the function, C++ is much more powerful than simple macro substitution.

In cases where speed is important (i.e., where you don't want the overhead of another call to a member function), C++ provides the new concept of inline functions. An inline function operates exactly like a multiline #define macro (a feature not all C compilers support), substituting its entire function body wherever the inline function is called. In the struggle between speed and speed, inline functions always save you the overhead of a function call at the expense of final execution-code size. Weigh the costs, and use these functions where appropriate.

The Event class has one inline function, `Event::mouse` (see listing 1). It's a private member function declared inline to avoid incurring the overhead of an additional call to the mouse-interface member function. I did this to speed up the call to the mouse interface, which is written in assembly language. (Note that the inline keyword in C++ is only a suggestion to the compiler.) Since the amount of assembly language in `Event::mouse` is small, the cost of inlining it is minimal.

Dealing with Data
With the overloaded Message function, you saw how the parameters of the function call dictate which call you use, rather than the other way around. You might even say that overloading can make your programs data-driven, in a narrow sense. Note that C++ supports variable numbers of arguments to functions and even permits you to assign default values to those arguments if you need to.

continued
Listing 1: The Event class.

class Event {
    public:
        DOSMSG DosMsg;
        // Class overhead and management;
        Event(); // Class constructor
        ~Event(); // Class destructor
        // Mouse-specific functions;
        BOOL HasMouse();
        POINT WhereMouseXY();
        BOOL SetMouseXY(int, int);
        // Keyboard-specific functions;
        int WhereX();
        int WhereY();
        POINT WhereXY();
        BOOL GotoXY(int, int);
        // Message retrieval;
        DOSMSG *GetMessage(char *, int);
        DOSMSG *GetMessage(BOOL);
        // Miscellaneous functions;
        void BellAlert(BOOL);
    private :
        int ClX; // Keyboard cursor (cursor #1)
        int ClY; // ibid.
        int C2X; // Mouse cursor (cursor #2)
        int C2Y; // ibid.
        int BUTTON; // 'L', 'R', NULL code
        int CTRLKEY; // Second value of scan code
        BOOL bMouseOn; // TRUE = mouse installed
        BOOL bBellOn; // BEEP on error
        int bx, ex, dx; // Used for register calls
        BOOL bMouseOn(); // TRUE = mouse installed
        BOOL bBellOn(); // BEEP on error
        int GetEvent(); // inline 4speed;
        int _mouse(int, int*, int*); // Only used for graphics mode
        void install_cursor_image(void); }

Listing 2: Event's constructor and destructor.

Event::Event() {
    CTRLKEY = NULL;
    bBellOn = TRUE;
    // Return TRUE if mouse installed
    bMouseOn = MouseReset();
    if(bMouseOn == TRUE) {
        bx = cx = dx = 0;
        // Turn the mouse on
        _mouse(MOUSE_OFF, &bx, &cx, &dx);
        MouseStatus();
        // Set C2X, C2Y, and BUTTON
        MouseStatus();
        // Only used for graphics mode
    }
    // init keyboard stuff
    WhereXY();
    _setcursortype(_NOCURSOR); } //Event()
A simple, single data structure lies at the heart of the Event class. In the DOS implementation, I’ve named that structure DOSMSG. Although the data structure can differ from platform to platform, that wasn’t required for the Event class: The structure was entirely adequate for the way events are gathered in OS/2, Unix, and DOS. However, if you need to prevent other classes from accessing some portion of a structure, then C++ allows you to declare parts of a structure private or public in the same manner as you would for a class. The default scope for class members is private, however, whereas the default scope for data structures is public.

When a DOSMSG structure is detected, Event::GetMessage returns a pointer to a structure that identifies all the information generated by the message. For example, mouse messages contain both the point at which they were generated (in the standard PC coordinate system, where 0,0 refers to the upper left corner of a positive coordinate plane) and what event caused the message (e.g., left mouse button or function key). Keyboard messages, on the other hand, contain a keystroke identifier and the location at which the key was pressed.

The message structure is declared as follows:

```c
typedef struct tagDOSMSG
{  
    int Type; // (key, mouse, etc.)
    int Msg;  // KEYS.H if key,
    // or mouse-message-id
    POINT pt; // location
} DOSMSG;
```

`POINT` is just a pair of integers. This structure is sufficient to convey all keyboard and mouse activity to programs on three operating systems. The `DOSMSG.Msg` value is a signed integer; however, those desiring better support for double-byte characters might want to change the type to `unsigned`.

Using the Event Class

Once a class has been defined, C++ allows you to use it directly or to derive a new class from it that inherits (but can redefine or extend) its functions and data. To subclass Event, you would use the following syntax:

```c
class MyEvent: public Event {...};
```

This says, “Create a new class named MyEvent based on the public portion of the Event class.” If you just want to use the class directly without any further modification, you need only declare an instance of it. You can do this either with the C++ new operator (close cousin to C’s `malloc`), or on the stack with a declaration like:

```c
Event InstanceOfEvent;
```

which calls the class constructor `InstanceOfEvent::Event` without further intervention. In C++, class constructors can have arguments and, like other class members, can be overloaded. Aside from being called once when the class is created, class constructors cannot be called by nonmember functions. Class destructors, on the other hand, can be called by anyone at any time and typically are not overloaded.

Here’s how you declare and then use an instance of the Event class:

```c
DOSMSG *pMsg;
Event InstanceOfEvent;
// Constructors are called
pMsg = InstanceOfEvent.GetMessage(BOOL);
```

This call to the overloaded function `GetMessage` in class `Event` will return the proper result: a pointer to a message structure.

When I first learned C++, I was intrigued by the ability to apply the C array operators “,” “* ” and “->” to any class member. Unlike standard C, C++ allows pointers to classes, data, and functions within classes to be manipulated just like C arrays. If you wanted to pass a pointer to `Event` to another set of routines that would need to work with the class, you could use pointers in this way:

```c
main()
{
    Event myEvent;
    ...  
    ReadSomeData(&myEvent); // The "&" is required.
    ...  
    ReadSomeData(Event *pEvent) // Could also be a void *
    { 
        MSG *pMsg;
        ...  
        pMsg = pEvent->GetMessage(pMsg);
    }
```

Once again, note that passing function pointers around is something you can handle in standard C (perhaps with a few cleverly defined macros tossed in for good measure), but in C++ your code will be much more readable and easier to maintain over time.

You may have noticed that under DOS, Event spends much of its time polling devices. On preemptive operating systems like OS/2 and Unix, this polling activity is not much of a problem, since sharing the CPU is accomplished by the kernel, without your program’s knowledge. Sharing the CPU under DOS, however, is a real issue.

Fortunately, running Windows in enhanced mode allows the 386 processor to run a DOS program in its own VM (virtual machine). This means that preemptive, nondeterministic multitasking can take place. Listing 3 shows how Event can detect that it’s running in a Windows-enhanced-mode VM and surrender time to Windows.

You might also want to execute another internal function while Event is checking for input. In such cases, Event could easily be modified to accept a pointer to a class (or to a single function) that would be called while Event was waiting for user activity. In this manner, the Event class itself could also provide your program with a platform-independent method for simple multitasking.

The C++ Advantage

I have focused on some of the practical aspects of using C++ in real-world programming situations, rather than on the more academic discussions of the advantages of using object-oriented programming techniques. The key advantage of using a language like C++ is not so much that it can do things that no other language can do, but that it can help you think in ways that you otherwise might not have considered.

Learning object-oriented design concepts and adapting them to the way you write your code today can also make porting and maintaining that code much easier in the future. However, there’s no substitute for good design. If you start with a good one, C++ will help you maintain it over time.

Editor’s note: The complete listings described in this article are available electronically. See page 5 for details.

Randall A. Nagy is a principal software development engineer for Informix in Lenexa, Kansas. He develops Windows, Unix, and OS/2 software. You can reach him on BIX c/o "editors," or on the Internet at rngy@informix.com.
What features could I possibly offer in a DOS-based browser utility to make you switch from what you've got? Superfast access to large files might tempt you. The ability to spawn the file browser as a resizable text window from within a program should pique your interest. LAN awareness (i.e., file sharing) is a possibility; it's more a necessity than a luxury these days.

How about fast search operations using the Boyer-Moore algorithm? If you're still not convinced you'd want it, what about having the source code at your disposal for customization or incorporation into other programs? This month's selection is LIST, a file browser that incorporates all these features into a simple but quite handy utility.

**Eyeing the Browser**

Some DOS-based file browsers operate slowly on large files or can't process them at all. To avoid this problem, I designed LIST to sometimes treat a file as a collection of lines of text and sometimes as a random-access set of blocks of characters.

**LIST is a text-viewing utility with all the extras**

This unusual mixture of line-oriented and random-access file I/O lets LIST move quickly through a file and still display the result in textual form. You can view the end of a 100-MB file as quickly as you can view the next screenful.

If invoked with no command-line parameters, LIST asks for a filename. You can give LIST a single parameter—a file specification indicating the files you want to see—and the browser will operate in full-screen mode. You can use four additional parameters (i.e., the corner coordinates) to make LIST window itself on the screen.

You can run the executable file as a child process from almost any language (or shell to it from BASIC). From C, you could use the following to spawn LIST as a window in the middle of the screen, showing all the files in the current directory:

```c
spawnl(P_WAIT,"list.exe",".*","4","10","22","70",NULL);
```

In addition to using the cursor and other keypad keys for scrolling and paging, LIST has a toggle key for wrapping lines at the right side of the window and displaying a file in either hexadecimal or ASCII form. The bottom line of the browser's screen shows the file's size and the date and time the file was last updated. LIST restores the screen upon exit, so you don't lose track of what you were doing when you launched. Finally, you can shell to DOS from within the browser.

When you search for text in a file, you tell LIST whether the search should be case-sensitive. LIST uses the Boyer-Moore algorithm to move quickly through the file. (Having the source code to the search routines may be reason enough to get LIST.)

I used Borland's C compiler to develop LIST, taking advantage of Borland-specific library routines such as clrscr(), crol(), gotoxy(), and textattr() to make life easier. You can use any version of Turbo C or Borland C++ to personalize LIST.

**MAC/ Tom Thompson**

**Pump Up the Finder**

A common complaint against System 7.0 is that copying files takes longer. Because the System 7.0 Finder lets you run copy operations in the background or abort them with a mouse-click, it needs to take brief breaks during the copy process. These breaks allow CPU time for the Mac OS (to handle user events) or other applications.

SpeedyFinder7, a shareware Control Panel by Victor Tan, does some clever patching to speed file copies without sacrificing usability. SpeedyFinder7 allocates larger buffers (whose size is determined automatically or by the user) to read more data blocks and boost file-copy throughput. My timings show that the file-copy time for sending files through an Ethernet network was halved, while the time for copying files between hard drives was reduced by nearly a third. SpeedyFinder7 also eliminates the zoom rectangles that appear when an application launches, and it displays icons that indicate floppy disk type.

Editor's note: Software Corner highlights public domain, freeware, and shareware programs. The programs are available electronically. See "Program Listings" on page 5 for details. We solicit your contributions. We pay $50 for any program we use. Write to: Software Corner, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.
IF LOGIC ALONE DOESN'T CONVINCE YOU TO USE PROGRESS, THEN HOW ABOUT A LITTLE PEER PRESSURE?

For the second consecutive year, Progress resoundingly swept all 18 categories of the Varbusiness Report Card. And for the fourth year in a row, Progress came out on top in the Datapro surveys. Once again, users rated Progress superior to competitors on everything from strength of product to quality of service and support. Which is only logical, since Progress is the one development system that gives you the flexibility to build and implement high performance applications independent of platforms and database systems. It even lets you deploy any application in both multi-user and client/server environments. But don't take our word for it. Listen to a source far more convincing. Your peers. For survey results or a test drive, call 1-800-4 PROGRESS.

THE APPLICATION DEVELOPER'S CHOICE.

Progress applications are fully portable across the broadest spectrum of hardware platforms, operating systems, network protocols and user interfaces. So many, in fact, that we had to list them here in small type: 'AIX/UNIX, Novell NLM, O/S/2, OS/400, UNIX, Ultrix, VMS, XENIX, Microsoft Windows, X Windows, DECnet, LAN Manager, Novell NetWare, TCP/IP and SNA APPC LU 5.2. Also, Progress lets you process information in other databases, including ADABAS, C.11AM, DB2, and IMS.
A NEW OS/2

There is no shortage of good news this month. By the time you read this, IBM should have released a new version of OS/2 (called 2.01 as this went to press) that’s not only faster in the graphics department but also supports Windows 3.1 binaries. And developers will love the Professional Developer’s Kit CD-ROM, which contains every piece of IBM software even vaguely related to OS/2.

ServicePak

Although the new version of OS/2 should be generally available by the time you read this, I’ve been working with IBM’s ServicePak, which updates your current copy of OS/2 2.0. You can find the upgrade either in the IBMOS2 forum on CompuServe or on IBM’s BBS at (404) 835-6600, or you can order the disks for $24.95 by calling (800) 342-6672.

The ServicePak includes major improvements in the Micrograf f 32-bit graphics engine, and support for Windows 3.1 binaries is on the way. Other improvements include ISO fonts and a Super VGA driver.

The graphics engine visibly improves the GUI speed on OS/2 2.0. For example, moving windows around on the Workplace Shell desktop is quicker. But it’s not exceptionally faster, and it took me a few minutes to figure out why. Much of what makes graphics fast or slow is the graphical driver, and the basic VGA driver that I’m using on my OS/2 system (none of the generic ET4000 drivers seems to work on my system) still employs mainly 16-bit code. But having the internal manipulations run faster has provided a boost to system performance. Perhaps 32-bit VGA drivers for us local-bus users will appear one day, or, as I imagine in my fondest dreams, perhaps S3 accelerator drivers.

There are still some annoying aspects to OS/2 that have not been addressed in the latest update. Like many OS/2 users, I boot OS/2 on some days and DOS on some others, using the boot/dos or boot/os2 command. Doing this, however, leads to a mildly problematic disk condition that CHKDSK refers to as “cross-linked extended attributes.” There seems to be nothing one can do about this except to run CHKDSK from a floppy disk.

To this point in OS/2 history, this problem has been, in general, innocuous. The updated OS/2, however, seems a bit more sensitive to it than previous versions; I was unable to open my Drives folder until I booted from a floppy disk (no small task in the OS/2 world, as those who’ve done it know) and then used CHKDSK to eliminate the cross-linked extended attributes.

On the other hand, the Windows 3.1 support in this release is very good—better, in fact, than I expected. The common dialog boxes have appeared for opening files and printer and font selection, and the Program Manager looks just like Windows 3.1’s Program Manager.

The speed of video operations matches that of 3.1. There are even some video operations that are faster under OS/2 than under 3.1. OS/2 doesn’t appear to incur much extra overhead. The bottom line: If you’ve been avoiding OS/2 solely because you’re afraid that it won’t run as quickly on your system as Windows will, you no longer have a reason not to run OS/2.

There is, however, an oddity about this release. Since April, IBM has released many patches that speed up the system or make it more stable. Perhaps the most famous is the file IBM1ST506.ADD, which is a driver for hard disks that emulates the standard ST506 interface on ISA-bus machines. Downloading and adding IBM1ST506.ADD speeds up disk access wonderfully under OS/2, and anyone who’s not got this file yet should definitely get it. IBM advises you to download and apply the ST506 patch to the ServicePak-equipped OS/2. I’m not sure why IBM didn’t just put the updated drivers and patches in the ServicePak, but I’m using the beta version; perhaps the final version won’t have this problem.

OS/2 Freebies

I got the Professional Developer’s Kit CD-ROM disc in the mail the other day, and my first thought was, “Hallelujah!” Anyone who’s installed OS/2 from floppy disks knows that disk flipping gets a bit old after you’ve reinstalled OS/2 for the third time. The idea that the whole bloody thing can be installed with just a few commands is the best news I’ve had since I started working with OS/2 five years ago.

After a bit of fiddling and some advice from some very helpful people at IBM, I got the thing running. It was truly great to finish an entire OS/2 installation in just a few minutes. I called the IBM folks who’d
Helped me to tell them how simple it turned out to be, and I asked how they planned to sell this CD-ROM version of OS/2.

"We're giving it away," they replied. I had to ask if I'd heard them correctly. I had, but there was a catch. This is all beta software, and IBM doesn't plan to release the final CD-ROM with all the software that's on this disc. It turns out that there's a lot more on there than just OS/2.

I hadn't looked at first. Since it's a developer's product, I figured I'd find a C compiler, a linker, some libraries, a debugger kernel, and the latest OS/2 beta version. But when I looked closer, my mouth dropped open. Besides the Service-Pak, it includes the latest C2 compiler, the debugger kernel, LAN Server 3.0 (server code, as well as requesters for DOS and OS/2 workstations), NetWare and TCP/IP code for OS/2 2.0, the Developer's Toolkit (containing tons of goodies and sample code along with several books, including the "red books" IBM distributes with technical information on OS/2 and PS/2), and several productivity tools.

There's more on this disc than buyers of the original OS/2 1.0 SDK (Software Development Kit) got for $3000. The productivity tools consist of a nifty collection of Presentation Manager utilities, including a magnify tool that works like the zoom tool shipped with the Windows SDK, a program that creates a single-disk bootable floppy disk for OS/2, a simple drawing program, a program-execution timer, a world globe viewer that shows the part of the world currently in daylight and the part that's in darkness, a screen-capture program, and many others.

**Visual Rexx**

Of all the productivity tools on the disc, I've played mostly with a single item that appeared down on the bottom of the list: Visual Rexx, a command scripting language that's similar to the DOS batch language, a TSO Clist, a CMS exec, or a Unix shell script.

I'm not the world's greatest fan of C programming. That's not an indictment of C programming or C programs; it's just one man's opinion. I'm not a professional programmer most of the time; I mainly consult, teach seminars, and write books. The only code I write these days is small utilities.

I loved Visual Basic for Windows for this reason: I could bang out a quickie utility in a few hours, even if I hadn't picked up Visual Basic in a few months. It's easy to learn, and it provides immediate gratification. I have gamed many times about the fact that Microsoft has a Visual Basic for OS/2—the Visual Basic manual is riddled with references that say things like "if you've got the OS/2 version of Visual Basic..."—but refuses to sell it.

What a pleasure it was to find Visual Rexx, which is much more powerful than the DOS batch language and has been supported in the OS/2 Standard Edition since version 1.3. But Rexx, like most procedural languages, has been slow to support GUIs directly. Visual Rexx solves this by simply adding a few functions to the basic Rexx repertoire that allow you to write Rexx routines that can put windows on the screen, draw objects, display text, and do all the things that you need done to build your own small Workplace Shell routine. In just a few lines of code, you can put up File/Open dialog boxes and build windows, listboxes, radio buttons—name it.

Notice I said that Rexx is suitable for building small routines. There's no getting around the fact that Visual Rexx is interpreted, rather than compiled. But it's still pretty fast; a Visual Rexx routine I wrote to run under OS/2 2.0 outpaced a similar Visual Basic routine under Windows 3.1 on the same machine. If IBM decides to ship Visual Rexx with all copies of OS/2—even the nonbeta ones—then it could get a real leg up on Microsoft, which makes Visual Basic an extra add-on.

But to get back to the Professional Developer's Kit itself: What is its future, and how do you get a copy? The IBM folks I talked with said that they intend to update it with new products, but only beta products. The license agreement on all the software expires when the shrink-wrapped version appears; for example, the November release of LAN Server 3.0 made my license for the beta version evaporate. If you like the beta product, IBM wants you to buy the final product—not an unreasonable request when you consider that the beta product doesn't cost a dime.

At this writing (late fall 1992), IBM was offering this CD-ROM free to any member of the IBM DAP (Developer's Assistance Program). You can get a DAP application by calling (800) 342-6672, by leaving a message in the OS2DEV forum on CompuServe, or by visiting an IBM booth at any trade show where the DAP exhibits. Get it while you can; it's possible that IBM may decide to restrict this to "professional developers," whatever that means.

Mark J. Minasi is a technical educator and author. His Arlington, Virginia–based firm runs seminars on advanced PC operating systems. He has recently authored Inside OS/2 2.0 from New Riders and The Windows Problem Solver from Sybex. You can reach him on BIX as "mjmminasi."
Type Contention

I upgraded from Windows 3.0 and Adobe Type Manager to Windows 3.1 a few months ago, and I'm having a problem using the TrueType screen fonts. I have a 486/33 with 16 MB of RAM and a Diamond Stealth video card with 1 MB of RAM. I'm running Windows at a resolution of 800 by 600 pixels.

The problem occurs when I'm typing a letter in Word for Windows and highlight words in boldface or italic. When I type the word have in boldface, every subsequent instance of the letters h, a, v, and e on that line appears as a mix of normal and boldface text. This behavior sometimes continues throughout the whole document. Occasionally, I'll go to the original line and delete a character, and Word acts like it updated the whole screen because that line corrects itself. Because of this, I find it a nuisance to work with TrueType fonts and have stuck with ATM.

Any idea what’s wrong?

Eric Carlino
Glenview, IL

Your problem is a conflict between TrueType and ATM. Windows is confused because it doesn’t know which screen font to display. Either use ATM (go into the Windows control panel and turn off the TrueType options) or disable ATM. Trying to use ATM and TrueType simultaneously will continue to cause problems.—Stan Wszola

Document Management for the Next Computer

I am interested in information on search-and-retrieval systems. This system must work with a scanner. I'd like to be able to fax from my machine and perform text retrieval on this data. I expect to manage 100 to 300 documents per day. About 75 people will have access to this data, possibly through a WAN (wide-area network). We would run this under Unix on Next computers and possibly Wyse terminals. Do you have any recommendations?

Cindy Castillo
Austin, TX

When we think of document management and Unix, we usually think of large, custom-developed systems that manage terabytes of information. A good example is the system at the U.S. Patent and Trademark office. Even though the databases may still be huge (e.g., the University of Toronto has a Kodak optical jukebox-driven, terabyte-size system), the user interface is much more to the scale and taste of the nontechnical user, and the workstations are from Next. You may see the result of that project appear as a commercial product shortly.

There's also a need for document management systems that are on the megabyte to gigabyte scale, like yours. There are a wide spectrum of products for personal computers. For the Next computer, you can look in Next's third-party products catalog. One product that fits your needs is Document Manager, which is available for $995 from Boss Logic (1901 Landings Dr., Mountain View, CA 94043, (415) 903-7000; fax (415) 903-7009).

For the scanner system you want, you might try the OCR Servant products from HSD Microcomputer U.S. (1350 Pear Ave., Suite C, Mountain View, CA 94043, (800) 828-5522 or (415) 964-1400; fax (415) 964-1538). Evaluate them carefully, as BYTE has not tested these products.—Ben Smith

Addressing the Hardware

I'm an Amiga user, and I recently received an IBM PS/2 for controlling a robot I'm building. I can figure out how to build a card, but I have no idea how to address it from Borland C. Do I need to know which card slot it is in, or do I set the address on the card itself? Also, how do I address I/O space and not system space?

Jonas Klein
Northfield, MA

The system architecture of Intel-based machines like the IBM PS/2 is significantly different from that of Motorola-based machines like the Amiga. Amiga peripherals are memory-mapped into the system address space. Although interface cards may also be memory-mapped in the Intel architecture, the PS/2 has a separate I/O bus for communicating with peripherals.

Whether you decide to use the I/O bus or memory mapping to communicate with your peripheral card, you need to decode the addresses on the card itself. The Micro Channel interface adds a level of complication since, to meet specifications, Micro Channel boards should provide the ability to dynamically configure their address I/O ranges using a setup utility. However, it is possible to inform the Micro Channel bus that your address ranges are hard-coded and cannot be adjusted. This is probably suitable for an experimenter's hand-built card, although it's unsuitable for a commercial product.

Once you've solved the hardware problem, communicating with the card from a high-level language is straightforward. Borland C provides low-level calls called OUTPORT and INPORT for writing and reading words. Bytes can be written with OUTPORTB and INPORTB. Microsoft compilers provide similar capabilities. It is also rather simple to write the low-level interface code in assembly language and call that directly from your C applications.—Raymond GA Cité

TV vs. Computer

When I turn on my 386 computer and Super VGA monitor, they send noise through the house wiring. The TV reception through the antenna gets fuzzy, and the situation has become a bone of contention with my family. What's happening, and how do I fix it?

Andre Segui
Clermont, GA

You're going to get RF radiation from all parts of your computer—that's the nature of the beast. RF radiation
can sneak out of the equipment through the case openings, the case itself, cables, modem connections—you name it. Too much, and you start to obliterate radio and TV reception.

To minimize the problem, make sure that all your equipment is rated for FCC Class B certification (i.e., consumer-equipment certification) and that your machine is installed with all the manufacturer's case parts in place. Keep your cables as short as possible, and use good-quality wire for video, modems, and printers—shielded if possible. For the TV antenna, a good-quality 75-ohm shielded cable will filter out a lot more noise than a standard flat 300-ohm cable. Keep the computer as far from the TV as possible, and try to plug it into a different circuit if you can.

If all else fails, invite the rest of your family to use the computer, and get them hooked on it. If they appreciate having one in the house as much as you do, perhaps they'll stop complaining!—Howard Eglowstein

Not Ready Reading Drive A

I'm writing a DOS data acquisition program that writes data to the disk. I'd like to intercept any errors generated when the program tries to write to a floppy drive (i.e., A or B) that doesn't contain a floppy disk. I work mainly in FORTRAN, with some subroutines in assembly language.

I've tried using FORTRAN's INQUIRE command and several INT 21h variations, but I'm still getting "Not Ready Reading Drive A - Abort, Retry, Fail?" messages. Commercial packages handle this. How can I?

Bert van de Burgt
Tallahassee, FL

DOS handles disk errors through its critical error handler, INT 24. When an error occurs while trying to read or write from a device, DOS sets the processor registers with error codes and other information and executes an INT 24. The default error handler gives you the "Abort, Retry, Fail?" prompt, but you're free to install your own handler. That's how the commercial packages do it.

Before accessing the disk, make sure your program takes control of INT 24. If something goes wrong, your program's handler will get control and can handle the error anyway it wants to. Any good DOS programmer's reference will have the details of how INT 24 works.

—Howard Eglowstein

Macs on the Internet

I have noticed an increase in information on the Internet and how to reach it. The on-line services provide convenient E-mail, but is it possible to have a network connection on a Mac with a dial-up service?

I have used NCSA Telnet with FTP to transfer files to a Silicon Graphics Iris Indigo, but both machines were connected by the Ethernet. What software is needed to make a connection to an Internet provider? Can a Mac have an IP connection without running a form of Unix?

Bruce Hamilton
aol.com/bhamilton

I'll start with your last question first to put things in perspective. Yes, a Mac can have an IP connection without running Unix. You need MacTCP and a Control Panel that implements the TCP/IP stack on the Mac OS. You'll need the latest version of MacTCP (1.1.1) to operate with System 7.1. To obtain it, order the MacTCP 1.1.1 Developer's Kit from ADBA, Apple Computer, P.O. Box 319, Buffalo, NY 14207, (716) 871-6555; fax (716) 871-6511. Ask for part number B0944LLIA, which sells for $100.

Next, obtain an IP number from your network administrator. This address is required to configure MacTCP, and you need a unique one so that when your Mac operates on the network, it won't conflict with other computers' IP addresses. With MacTCP installed, you can connect to Unix workstations using TCP/IP over the Ethernet in two ways.

If your Mac is connected to the network with LocalTalk, you need a router (e.g., the Cayman Systems Gateway to AIX or Shiva's FastPath 5) to transfer the TCP/IP traffic between LocalTalk and the Ethernet. With this arrangement, you'll definitely need the network administrator to set up the IP number, plus any additional information the router might require to handle the address mapping between the two networks. If you've already cabled the Ethernet, either through an Ethernet board or because you're lucky enough to own a Mac Quadra, you simply need to get an IP address.

Now for your first question. You are familiar with the Internet, which requires MacTCP to provide the TCP/IP communications that are required. The latest version of Telnet (2.5) supports both serial and SLIP connections. The serial connection establishes a console window-style session with a remote Unix system. SLIP establishes a serial connection that resembles an actual Ethernet connection. You'll need a modem, the phone number of the host system's modem, and a log-in name and password.

To establish the serial connection, you check the serial or SLIP box in Telnet's Open Connection dialog box. In the window that appears, you type the phone number of a Unix workstation that operates as a terminal server. When the connection is made, you use the name and password to log into the system. For SLIP, you'll need the phone number of the host system's modem and its IP number. Also, the host system has to be configured to recognize and handle a SLIP connection. For more information, consult the Telnet 2.5 documentation files, which are available on most on-line networks.

Why did I mention the Ethernet connection when you want to connect to a remote site? Because an Internet connection might be only as far away as your Unix wizard. At BYTE, I use MacTCP and Telnet 2.5 over the Ethernet to log into byteby, a Unix workstation whose duty is to handle our Internet mail. This saves me the effort and expense of contacting a remote system. It's like dropping the mail off at your local post office—convenient.

The BYTE Lab welcomes your questions. Address correspondence to Ask BYTE, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. You can also send BIX mail to "editors." We read every letter, but due to the volume of mail received, we cannot guarantee a response. We edit all letters for brevity.
Explore UNIXWORLD...Risk Free!

Yes! Start my one-year (12 issues) subscription for only $18.00. That's 50% off the newsstand price.

NAME (please print) ________________________________________________ TITLE _________________________

COMPANY NAME: _________________________________________________

ADDRESS ________________________________________________________

CITY ___________________________ STATE _______________ ZIP __________

[ ] BILL ME AT $18.00* [ ] PAYMENT ENCLOSED [ ] PLEASE CHARGE MY VISA [ ] MASTERCARD [ ] AMEX

CARD #: ___________________________ EXPIRATION DATE ____________ SIGNATURE ____________

*U.S.A. ONLY. Canadian: 1 yr. $24. Other Foreign: 1 yr. $51 air delivery. All foreign orders must be prepaid in U.S. funds.

Please complete all questions to qualify for the rates shown above. Subscriptions at the above rates are limited to persons with active professional, functional and managerial responsibilities in UNIX or XENIX computing. Other subscriptions: $36 a year in U.S., Canada: $48, Other Foreign: $102 air delivery.

CIRCLE ONE ONLY
My company's primary business

a. Mfg. of Comp./Comp. Equip.
b. Other Manufacturing
c. Systems Integrator/House
d. Software Developer
e. VAR, Dealer or Distributor
f. Communications/Telephone
g. Transportation/Utilities
h. Mining or Construction
i. Fin./Ins./Real Estate
j. Wholesale or Retail Trade
k. Consulting
l. Government or Military
m. School or University
n. Other:

CIRCLE ONE ONLY
My primary job function

a. Corp. or Financial Mgmt.
b. MIS/DP Mgmt.
c. Office Mgmt./Administration
d. Network Mgmt./Telecommunications
e. Systems Integration
f. Design or Dev. Engineering
g. Prag/Sw Development
h. Research/Analysis
i. Marketing or Sales
j. Purchasing
k. Mfg./Production
l. Distribution
m. Education/Teaching
n. Consulting
o. Government/Public Admin.
p. Other:
q. Technical Staff/Eng. Support

CIRCLE ONE ONLY
The number of employees at all locations of my company

a. Under 10
b. 10 - 49
c. 50 - 249
d. 250 - 999
e. 1,000 - 4,999
f. 5,000 or more

CIRCLE ALL THAT APPLY
I purchase/influence the purchase of the following:

a. Mainframe Computers
b. Minis/Supercrunchers
c. Micros/Supercrunchers
d. Workstations
e. Brain-Level Products
f. Terminals
g. Printers
h. Disk Drives
i. Tape Drives
j. Modems/Multiplexers
k. LAN Equipment
l. Software

ZB38505

Your No-Risk Guarantee: I may cancel at any time and receive a refund for the balance of my subscription. Please allow 6-8 weeks for processing.
UNIX is changing the world of computers, the world of business — quite simply, changing the world. It’s revolutionizing office automation. It’s required for U.S. government computer contracts. It’s the backbone of information strategies worldwide.

That’s why you need **UNIXWorld** — the magazine that keeps you up to date on the rapidly changing world of open systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help your company use UNIX to its fullest. And unbiased hardware and software reviews to help you invest wisely when you buy.

**UNIXWorld**’s in-depth features go beyond dry technical facts to show how the pieces fit together — to tell you what’s important about the advances and strategies that are changing your world. And **UNIXWorld** consistently offers the freshest, most down-to-earth writing that you’ll find in any computer publication.

Subscribe today and receive the next 12 issues of **UNIXWorld** for just $18.00 — half the regular newstand price. Save even more by ordering for two or three years. You can’t lose—every subscription to **UNIXWorld** comes with a no-risk guarantee*.

*UNIXWorld’s no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of your subscription.

UNIX is a registered trademark of UNIX System Laboratories, Inc.
If your board doesn't say Quatech Inc., you may be missing something...

Ask a Quatech sales Engineer to show you the value of quality, service and support.

- Quatech manufactures a complete line of data acquisition, communication, and Micro Channel boards for the PC AT/XT, PS/2 and compatible computers.
- Quatech's user friendly software drivers enable our full featured adapters to support most popular operating systems.
- Quatech's adapters are backed by our free on-line technical support.

For a free catalog call: 800-553-1170

Mail Order
The latest offerings from vendors supplying products of all leading manufacturers at extremely competitive prices.

Hardware/Software Showcase
This categorized four-color display section makes it easy to find Hardware and Software products from a wide variety of manufacturers and suppliers.

Buyer's Mart
From Accessories to Laptops to Word Processors, you can easily find the dealers you are looking for in this directory of products and services.
The Cost of 486 Power is Falling Fast.

AND LODESTAR'S VALUE KEEPS GOING UP:

CONSIDER THESE EISA FEATURES: We've carefully designed a 32-bit processing solution that breaks through the ISA bottleneck while maintaining downward compatibility with a 16-bit Bus for a peak data transfer rate of 33 MB/sec. Six, true, fully blown EISA Bus Mastering slots plus two EISA slave slots so you can be assured your EISA mastering add-on cards will work for you (typical 8 slave slots won't).

LODESTAR's bus mastering, intelligent expansion cards with their own I/O processors operating in parallel with the main CPU, frees up your load on the CPU. Bus throughput is improved by implementing direct memory access (DMA) and bus masters.

Its speed performance capability provides you with an ideal solution for a wide range of demanding applications, like CAD/CAM/CAE, formidable database management, image processing, artificial intelligence, desktop publishing and in the environments of network and multiuser systems.
How thousands of our customers are BUYING DIRECT

When they buy from us, they’re buying directly from the factory. So they get more value with each purchase, and are always assured their system is backed directly by the people who assembled it.

386-SX Workstation
386-SX/25
• 2MB RAM expandable to 32MB
• 85MB IDE hard drive w/cache
• 1:1 Interleave 2H/2F IDE controller
• 1.2MB 5.25” & 1.44MB 3.5” floppy drives
• 16-bit 1024x768 SVGA card w/1MB RAM
• 14” 1024x768 0.28mm dot pitch SVGA color monitor
• 2 serial, 1 parallel & 1 game port
• MS DOS 5.0 & MS Windows 3.1
• Enhanced 101-key keyboard
• High resolution serial mouse
• Mini-vertical case
$1099

386-DX Workstation
386-DX/25
• 4MB RAM expandable to 32MB
• 130MB 15ms IDE hard drive w/64F cache
• 1:1 Interleave 2H/2F IDE controller
• 1.2MB 5.25” & 1.44MB 3.5” floppy drives
• 16-bit 1024x768 SVGA card w/1MB RAM
• 14” 1024x768 non-interlaced 0.28mm dot pitch SVGA color monitor
• 2 serial, 1 parallel & 1 game port
• MS DOS 5.0 & MS Windows 3.1
• Enhanced 101-key keyboard
• High resolution serial mouse
• Desktop or mini-vertical case
$1359

StarFlex 3/486C
386-DX/25
• CPU upgradable to 386DX, 486DX, 486DX2. Up to 66MHz
• 4MB ultrafast write-back cache RAM expandable to 256K
• 4MB fast RAM expandable to 32MB
• 130MB 15ms IDE drive w/64F cache
• 1MB 5.25” & 1.44MB 3.5” drives
• 1MB SVGA non-interlaced color card w/1MB RAM
• 14” 1024x768 non-interlaced 0.28mm dot pitch SVGA color monitor
• VESA 72Hz flicker-free display
• 2 serial, 1 parallel & 1 game port
• MS DOS 5.0, Windows 3.1 & mouse
• Enhanced 101-key keyboard
• Desktop or mini-vertical case
$1459

NOW $1099
NOW $1359
NOW $1459

Your Assurance of Complete Satisfaction
OUR RISK-FREE GUARANTEE

Look for your comprehensive, written guarantee when you take delivery of any LODESTAR system. This industry-acclaimed FIVE WAY Personal Warranty proves our willingness to stand behind everything you buy from LODESTAR.

CALL FOR YOUR FREE COPY: we’ll fax or mail it immediately. Use the LODESTAR FIVE-WAY GUARANTEE as your shopping guide; compare and question the others before ordering.

1-800-875-3818

GOVERNMENT, SCHOOL, AND CORPORATE ORDERS WELCOME. TO RECEIVE YOUR FREE COPY OF OUR PRODUCT CATALOG, JUST CALL.
<table>
<thead>
<tr>
<th>Product Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>386DX-40-256K Cache WICPU</td>
<td>$385</td>
</tr>
<tr>
<td>386DX-33-64K Cache WICPU</td>
<td>$395</td>
</tr>
<tr>
<td>386DX-60-128K Cache WICPU</td>
<td>$325</td>
</tr>
<tr>
<td>386DX-70-256K Cache WICPU</td>
<td>$335</td>
</tr>
<tr>
<td>4MB X 9-60NS SIMM</td>
<td>$256</td>
</tr>
<tr>
<td>4MB X 9-70NS SIMM</td>
<td>$286</td>
</tr>
<tr>
<td>4MB X 9-80NS SIMM</td>
<td>$306</td>
</tr>
<tr>
<td>8MB X 9-60NS SIMM</td>
<td>$386</td>
</tr>
<tr>
<td>8MB X 9-70NS SIMM</td>
<td>$406</td>
</tr>
<tr>
<td>8MB X 9-80NS SIMM</td>
<td>$426</td>
</tr>
<tr>
<td>8MB X 9-90NS SIMM</td>
<td>$446</td>
</tr>
<tr>
<td>16MB X 9-60NS SIMM</td>
<td>$506</td>
</tr>
<tr>
<td>16MB X 9-70NS SIMM</td>
<td>$526</td>
</tr>
<tr>
<td>16MB X 9-80NS SIMM</td>
<td>$546</td>
</tr>
<tr>
<td>16MB X 9-90NS SIMM</td>
<td>$566</td>
</tr>
<tr>
<td>1MB X 9-60NS 3 CHIP SIMM</td>
<td>$75</td>
</tr>
<tr>
<td>1MB X 9-70NS 3 CHIP SIMM</td>
<td>$80</td>
</tr>
<tr>
<td>1MB X 9-80NS 3 CHIP SIMM</td>
<td>$85</td>
</tr>
<tr>
<td>1MB X 9-90NS 3 CHIP SIMM</td>
<td>$90</td>
</tr>
<tr>
<td>1MB X 9-100NS 9 CHIP SIMM</td>
<td>$95</td>
</tr>
<tr>
<td>1MB X 9-110NS 9 CHIP SIMM</td>
<td>$100</td>
</tr>
<tr>
<td>1MB X 9-120NS 9 CHIP SIMM</td>
<td>$105</td>
</tr>
<tr>
<td>2MB X 9-60NS SIMM</td>
<td>$165</td>
</tr>
<tr>
<td>2MB X 9-70NS SIMM</td>
<td>$185</td>
</tr>
<tr>
<td>2MB X 9-80NS SIMM</td>
<td>$205</td>
</tr>
<tr>
<td>2MB X 9-90NS SIMM</td>
<td>$225</td>
</tr>
<tr>
<td>2MB X 9-100NS SIMM</td>
<td>$245</td>
</tr>
<tr>
<td>2MB X 9-110NS SIMM</td>
<td>$265</td>
</tr>
<tr>
<td>2MB X 9-120NS SIMM</td>
<td>$285</td>
</tr>
<tr>
<td>2MB X 9-130NS SIMM</td>
<td>$305</td>
</tr>
<tr>
<td>4MB X 9-60NS SIMM</td>
<td>$396</td>
</tr>
<tr>
<td>4MB X 9-70NS SIMM</td>
<td>$416</td>
</tr>
<tr>
<td>4MB X 9-80NS SIMM</td>
<td>$436</td>
</tr>
<tr>
<td>4MB X 9-90NS SIMM</td>
<td>$456</td>
</tr>
<tr>
<td>4MB X 9-100NS SIMM</td>
<td>$476</td>
</tr>
<tr>
<td>4MB X 9-110NS SIMM</td>
<td>$496</td>
</tr>
<tr>
<td>4MB X 9-120NS SIMM</td>
<td>$516</td>
</tr>
<tr>
<td>4MB X 9-130NS SIMM</td>
<td>$536</td>
</tr>
<tr>
<td>4MB X 9-140NS SIMM</td>
<td>$556</td>
</tr>
<tr>
<td>8MB X 9-60NS SIMM</td>
<td>$806</td>
</tr>
<tr>
<td>8MB X 9-70NS SIMM</td>
<td>$826</td>
</tr>
<tr>
<td>8MB X 9-80NS SIMM</td>
<td>$846</td>
</tr>
<tr>
<td>8MB X 9-90NS SIMM</td>
<td>$866</td>
</tr>
<tr>
<td>8MB X 9-100NS SIMM</td>
<td>$886</td>
</tr>
<tr>
<td>8MB X 9-110NS SIMM</td>
<td>$906</td>
</tr>
<tr>
<td>8MB X 9-120NS SIMM</td>
<td>$926</td>
</tr>
<tr>
<td>8MB X 9-130NS SIMM</td>
<td>$946</td>
</tr>
<tr>
<td>8MB X 9-140NS SIMM</td>
<td>$966</td>
</tr>
<tr>
<td>16MB X 9-60NS SIMM</td>
<td>$1606</td>
</tr>
<tr>
<td>16MB X 9-70NS SIMM</td>
<td>$1806</td>
</tr>
<tr>
<td>16MB X 9-80NS SIMM</td>
<td>$2006</td>
</tr>
<tr>
<td>16MB X 9-90NS SIMM</td>
<td>$2206</td>
</tr>
<tr>
<td>16MB X 9-100NS SIMM</td>
<td>$2406</td>
</tr>
<tr>
<td>16MB X 9-110NS SIMM</td>
<td>$2606</td>
</tr>
<tr>
<td>16MB X 9-120NS SIMM</td>
<td>$2806</td>
</tr>
<tr>
<td>16MB X 9-130NS SIMM</td>
<td>$3006</td>
</tr>
<tr>
<td>16MB X 9-140NS SIMM</td>
<td>$3206</td>
</tr>
<tr>
<td>32MB X 9-60NS SIMM</td>
<td>$3206</td>
</tr>
<tr>
<td>32MB X 9-70NS SIMM</td>
<td>$3406</td>
</tr>
<tr>
<td>32MB X 9-80NS SIMM</td>
<td>$3606</td>
</tr>
<tr>
<td>32MB X 9-90NS SIMM</td>
<td>$3806</td>
</tr>
<tr>
<td>32MB X 9-100NS SIMM</td>
<td>$4006</td>
</tr>
<tr>
<td>32MB X 9-110NS SIMM</td>
<td>$4206</td>
</tr>
<tr>
<td>32MB X 9-120NS SIMM</td>
<td>$4406</td>
</tr>
<tr>
<td>32MB X 9-130NS SIMM</td>
<td>$4606</td>
</tr>
<tr>
<td>32MB X 9-140NS SIMM</td>
<td>$4806</td>
</tr>
<tr>
<td>64MB X 9-60NS SIMM</td>
<td>$6406</td>
</tr>
<tr>
<td>64MB X 9-70NS SIMM</td>
<td>$6606</td>
</tr>
<tr>
<td>64MB X 9-80NS SIMM</td>
<td>$6806</td>
</tr>
<tr>
<td>64MB X 9-90NS SIMM</td>
<td>$7006</td>
</tr>
<tr>
<td>64MB X 9-100NS SIMM</td>
<td>$7206</td>
</tr>
<tr>
<td>64MB X 9-110NS SIMM</td>
<td>$7406</td>
</tr>
<tr>
<td>64MB X 9-120NS SIMM</td>
<td>$7606</td>
</tr>
<tr>
<td>64MB X 9-130NS SIMM</td>
<td>$7806</td>
</tr>
<tr>
<td>64MB X 9-140NS SIMM</td>
<td>$8006</td>
</tr>
<tr>
<td>128MB X 9-60NS SIMM</td>
<td>$12806</td>
</tr>
<tr>
<td>128MB X 9-70NS SIMM</td>
<td>$13006</td>
</tr>
<tr>
<td>128MB X 9-80NS SIMM</td>
<td>$13206</td>
</tr>
<tr>
<td>128MB X 9-90NS SIMM</td>
<td>$13406</td>
</tr>
<tr>
<td>128MB X 9-100NS SIMM</td>
<td>$13606</td>
</tr>
<tr>
<td>128MB X 9-110NS SIMM</td>
<td>$13806</td>
</tr>
<tr>
<td>128MB X 9-120NS SIMM</td>
<td>$14006</td>
</tr>
<tr>
<td>128MB X 9-130NS SIMM</td>
<td>$14206</td>
</tr>
<tr>
<td>128MB X 9-140NS SIMM</td>
<td>$14406</td>
</tr>
<tr>
<td>256MB X 9-60NS SIMM</td>
<td>$25606</td>
</tr>
<tr>
<td>256MB X 9-70NS SIMM</td>
<td>$25806</td>
</tr>
<tr>
<td>256MB X 9-80NS SIMM</td>
<td>$26006</td>
</tr>
<tr>
<td>256MB X 9-90NS SIMM</td>
<td>$26206</td>
</tr>
<tr>
<td>256MB X 9-100NS SIMM</td>
<td>$26406</td>
</tr>
<tr>
<td>256MB X 9-110NS SIMM</td>
<td>$26606</td>
</tr>
<tr>
<td>256MB X 9-120NS SIMM</td>
<td>$26806</td>
</tr>
<tr>
<td>256MB X 9-130NS SIMM</td>
<td>$27006</td>
</tr>
<tr>
<td>256MB X 9-140NS SIMM</td>
<td>$27206</td>
</tr>
<tr>
<td>512MB X 9-60NS SIMM</td>
<td>$51206</td>
</tr>
<tr>
<td>512MB X 9-70NS SIMM</td>
<td>$51406</td>
</tr>
<tr>
<td>512MB X 9-80NS SIMM</td>
<td>$51606</td>
</tr>
<tr>
<td>512MB X 9-90NS SIMM</td>
<td>$51806</td>
</tr>
<tr>
<td>512MB X 9-100NS SIMM</td>
<td>$52006</td>
</tr>
<tr>
<td>512MB X 9-110NS SIMM</td>
<td>$52206</td>
</tr>
<tr>
<td>512MB X 9-120NS SIMM</td>
<td>$52406</td>
</tr>
<tr>
<td>512MB X 9-130NS SIMM</td>
<td>$52606</td>
</tr>
<tr>
<td>512MB X 9-140NS SIMM</td>
<td>$52806</td>
</tr>
<tr>
<td>1GB X 9-60NS SIMM</td>
<td>$102406</td>
</tr>
<tr>
<td>1GB X 9-70NS SIMM</td>
<td>$102606</td>
</tr>
<tr>
<td>1GB X 9-80NS SIMM</td>
<td>$102806</td>
</tr>
<tr>
<td>1GB X 9-90NS SIMM</td>
<td>$103006</td>
</tr>
<tr>
<td>1GB X 9-100NS SIMM</td>
<td>$103206</td>
</tr>
<tr>
<td>1GB X 9-110NS SIMM</td>
<td>$103406</td>
</tr>
<tr>
<td>1GB X 9-120NS SIMM</td>
<td>$103606</td>
</tr>
<tr>
<td>1GB X 9-130NS SIMM</td>
<td>$103806</td>
</tr>
<tr>
<td>1GB X 9-140NS SIMM</td>
<td>$104006</td>
</tr>
</tbody>
</table>

*Some products are not available for worldwide delivery. Please check availability before placing an order.*
MegaCube EISA Bus
486-33 MHz System
8 meg, 128K Cache, SCI ... CALL
Carrier 386sx/25 MHz Notebook
4 meg, 120 meg Hard Drive, VGA ... CALL

Toshiba Notebooks
Toshiba 1850, 80 meg ... 1985
Toshiba 4400C, 120 meg ... 2525
Toshiba 6400xc, 120 meg ... CALL
Toshiba 3300lx, 80 meg ... CALL
Toshiba 4500, 120 meg ... CALL
Toshiba 4500, 200 meg ... CALL
Call for pricing on other brand name models

CD ROM/Multi Media
NEC CD ROM 36M Gallery ... 570
NEC CD ROM 74M Gallery ... 680
Sound Blaster Pro ... 205

We Stock Sharp Notebook
Made in USA

Citizen
Hitachi
NEC
Houston Instruments
Microsoft
Intell

Printers

LAN Boards

8 bit Arcnet ... 75
16 bit Arcnet ... 160
Novell NE 1000 ... 160
Novell NE 2000 ... 175
8 port Active Hub ... 325
Token Ring Card ... 399
Tokenhub 4-port ... 555
Call for other LAN Accessories

SVGA Monitors

NEC 3DFX, 14" ... 665
NEC 4FG, 16" ... 825
Viewsonic 4E, 14" ... 365
Viewsonic 8, 17" ... 378
Amazing, 14" ... 335

One year limited warranty

Computerlane Inc.
Outside California: 1-800-526-3482
Inside California: 818-884-8644 • FAX: 818-884-8253
7500 Topanga Canyon Boulevard, Canoga Park, CA 91303
Hours: Monday - Friday 9 - 6, Saturday 10 - 5

Compaq is a Registered Trademark of Compaq, IBM is a Registered Trademark of International Business Machines.

Circle 169 on Inquiry Card.

FEBRUARY 1993 • BYTE 247
Your Super Direct source for computers, hardware and software.

Insight 486 ISA
- Fully Upgradable Intel 80486 CPU
- 4MB RAM - 256K Cache
- 210MB 12ms Hard Drive w/cache
- 420MB with Stacker®
- Non-Interlaced 14" Super VGA Color Monitor
- 24 Bit 1MB Graphics Accelerator
- Super VGA Video Card - Up to 16 Million Colors
- 1.2MB 5.25" Floppy Drive
- 1.44MB 3.5" Floppy Drive
- 2 Serial Ports, 1 Parallel, 1 Game Port
- Enhanced 101 Key Keyboard
- MS-DOS 5.0
- Mouse
- Full Vertical Case
- 250 Watt Power Supply
- Stacker and Dr. Solomon's Anti-Virus™ Software
- Intel OverDrive™ Socket

486SX-25MHz
$1,599

486-33MHz
$1,899

486DX-50MHz
$1,999

486-50MHz
$2,099

486DXI-66MHz
$2,299

Faster Than A Speeding Bullet!

No time to wait for a fully-loaded, value-packed 486? No problem! We’ve specially configured and pre-built our hottest selling systems and they’re ready to ship!

CD-ROM

Talon TA-100
- Internal, 380ms access time, 32KB buffer, fast transfer rate.
- $219

Sony S-31A
- Internal, 490ms access time, 64KB buffer, 150KB/second transfer rate.
- Photo CD compatible.
- $399

Talon High Performance TA-200
- Internal, 280ms access time, 64KB buffer, 300KB/second transfer rate.
- $599

Free with any CD-ROM drive -
- 1992 Multimedia Encyclopedia
- Stereo Headphones
- Reference Library
- Game Pack.

1992 Toolworks Multimedia Encyclopedia - complete 21 volume set. Over 33,000 articles with 3,000 pictures, 250 maps, 35 minutes of video, 35 minutes of sound recordings and 55 video sequences.

Ask about Multimedia Kits!

CD Software - Pick 5 for $99*
- Aircraft Encyclopedia
- Bible Library
- Career Opportunities
- CIA Factbook
- Civil War
- European Monarchs
- Guinness Disc
- Great Cities (MM)
- Interactive Storytim
e
- KGB Factbook
- Korea
- MM Mavis Beacon
- Trenches Typing
- N. American Indians
- American Business
- Phone Book

*with purchase of a CD-ROM Drive or Multimedia Kit.

Ask about Multimedia Kits!

Super Selection.
Super Service. Super Direct!
1000's of Products. Call Now!

120MB to 2100MB Hard Drives

<table>
<thead>
<tr>
<th>Size</th>
<th>IDE/SCSI</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>120MB</td>
<td>IDE</td>
<td>Bare $279, 16 Bit Kit $319</td>
</tr>
<tr>
<td></td>
<td>IDE</td>
<td>$299</td>
</tr>
<tr>
<td>520MB</td>
<td>IDE/SCSI</td>
<td>Fujitsu FJ26264S, 12ms 3.5&quot; HH Bare $999, 16 Bit Kit (IDE) $1,019, 16 Bit Kit (SCSI) $1,149</td>
</tr>
<tr>
<td></td>
<td>IDE/SCSI</td>
<td>$2,749</td>
</tr>
<tr>
<td>1350MB</td>
<td>SCSI</td>
<td>Micropolis MC1528-15, 14ms 5.25&quot; FH Bare $1,799, 16 Bit Kit $1,949</td>
</tr>
</tbody>
</table>

Tape Backups

Standard QIC 80 attatches to existing floppy controller or dedicated unit, w/ data compression. 2-3MB/min.

Talon By Colorado

<table>
<thead>
<tr>
<th>Size</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>120MB includes one tape</td>
<td>$189</td>
</tr>
<tr>
<td>250MB includes one tape</td>
<td>$249</td>
</tr>
</tbody>
</table>

Colorado

<table>
<thead>
<tr>
<th>Size</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>120MB</td>
<td>$199</td>
</tr>
<tr>
<td>250MB</td>
<td>$259</td>
</tr>
</tbody>
</table>

Printers

Canon

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>BJ-10ex</td>
<td>$289</td>
</tr>
<tr>
<td>BJ-20</td>
<td>$379</td>
</tr>
<tr>
<td>BJ-200</td>
<td>$339</td>
</tr>
<tr>
<td>BJ-300 Bubble Jet</td>
<td>$419</td>
</tr>
<tr>
<td>BJ-330 Bubble Jet</td>
<td>$579</td>
</tr>
<tr>
<td>BJC-800 Color Bubble Jet</td>
<td>$1,899</td>
</tr>
<tr>
<td>BJC-420 (SCSI) Color Bubble Jet</td>
<td>$1,999</td>
</tr>
<tr>
<td>LBP-4ks</td>
<td>$899</td>
</tr>
<tr>
<td>LBP-8xs</td>
<td>$1399</td>
</tr>
</tbody>
</table>

NEC

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3200 - 8K, up to 216 CPS</td>
<td>$229</td>
</tr>
<tr>
<td>P6200 - 80K, up to 300 CPS</td>
<td>$409</td>
</tr>
<tr>
<td>P3300 - 8K, up to 216 CPS</td>
<td>$239</td>
</tr>
<tr>
<td>P6300 - 80K, up to 300 CPS</td>
<td>$629</td>
</tr>
<tr>
<td>P9300 - 80K, up to 400 CPS</td>
<td>$829</td>
</tr>
<tr>
<td>Model 95 Laser Printer</td>
<td>$1,399</td>
</tr>
</tbody>
</table>

Monitors

TVM

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MediaScan 4A+ 14&quot;</td>
<td>$319</td>
</tr>
<tr>
<td>Low Radiation 5A+ 15&quot;</td>
<td>$529</td>
</tr>
<tr>
<td>MediaScan 6A 17&quot;</td>
<td>$1,039</td>
</tr>
</tbody>
</table>

NSA/Hitachi

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>SuperScan™ 15 (CM1584)</td>
<td>$579</td>
</tr>
<tr>
<td>SuperScan™ 17 (CM1785)</td>
<td>$1,099</td>
</tr>
<tr>
<td>SuperScan™ 20 (CM2085)</td>
<td>$1,499</td>
</tr>
</tbody>
</table>

NEC

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MultiSync 3F0x 15&quot;</td>
<td>$639</td>
</tr>
<tr>
<td>MultiSync 4FG 15&quot;</td>
<td>$749</td>
</tr>
<tr>
<td>MultiSync 5FG 17&quot;</td>
<td>$1,349</td>
</tr>
<tr>
<td>MultiSync 6FG 21&quot;</td>
<td>$2,359</td>
</tr>
</tbody>
</table>

Software

OmegA

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoMap</td>
<td>$49</td>
</tr>
<tr>
<td>Lotus SmartSuite for Windows</td>
<td>$419</td>
</tr>
<tr>
<td>Microsoft Excel 4.0</td>
<td>$295</td>
</tr>
<tr>
<td>Microsoft Word 2.0</td>
<td>$295</td>
</tr>
<tr>
<td>Paradox 4.0</td>
<td>$499</td>
</tr>
</tbody>
</table>

Networking

ARTISOFT

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>LANastic AE-2™ Ethernet Starter Kit (ISA)</td>
<td>$479</td>
</tr>
<tr>
<td>LANastic AE-7™ Ethernet Starter Kit (ISA)</td>
<td>$549</td>
</tr>
</tbody>
</table>

Other Networking Products Available.

All versions and upgrades available at the lowest prices.

800-998-8040

Insight

Buy the Super Direct way!

Hard Drives International and Insight have joined forces to bring you a superstore in your mailbox. We offer the ultimate selection of today's most popular hardware and software, with the most affordable prices. Get Insight's superior service and support, plus 1000's of products to choose from. It's the Super Direct™ way to have it all - direct to your door faster than a speeding bullet.

Super selection.
You'll find everything you need at Insight. From high-capacity, high-performance storage products to computer systems, peripherals, software and more. If you don't see the product you need, call us. We have 1000's of products in stock.

Super service.
- 30-Day "Worry-Free" Money Back Guarantee
- Federal Express Delivery
- Toll-Free Technical Support 7 Days a Week
- Payment Options Galore
- Order 24hrs a Day
- One Year Parts & Labor Warranty/Replacement Policy
- Special National Accounts Department for Larger Customers

Super Direct™
Order 24 Hours a Day
800-998-8040
National Accounts - P.O.'s
800-998-8014
APO/FPO/International
602-350-1145
FAX 602-350-1188
Insight Distribution Network Inc.
1912 W. Fourth St.
Tempe, AZ 85281
PH: 602-255-1128
FAX: 602-255-1159

Source Code: 8040
**Advanced Computer Products, Inc.**

3101 E. Edinger, Santa Ana, CA 92705 • FAX 714-558-8849 • Toll-Free 1-800-FOONE ACP • Sales 714-558-8813

Prices subject to change without notice. No surcharges on credit cards. Credit cards not charged until we ship. 100% tax free return guaranteed if you are not 100% satisfied just return within 15 days complete with all materials in new resalable condition with original invoice. ACP will immediately exchange product or issue ACP credit less shipping for future purchase. No returns on software Special Purchase

Circle 166 on Inquiry Card (RESELLERS: 167).
Rack Mount Computers - Motherboard or Passive Backplane

Use external monitor
Up to 6 drives
8.75" high

Mono or color monitor
Up to 5 drives
8.75" high

14" color monitor
Up to 3 drives
12.25" high

Rack Mount Monitors

10" mono or color monitor
8.75" high

14" mono or color monitor
12.25" high

Enclosure for most desk top monitors
14.0" high

Rack Mount Keyboards

Drawer mounted keyboard
1.75" high

Drawer for desk top keyboards
3.5" high

Vertical-mount, sealed membrane keyboard
5.25" high

Rack Mount Printer

Dot matrix printer with industrial rating
12.25" high

Call for our other Rack Mount computer and "enclosure only" product offerings.

RECORTEC, INC.

1290 Lawrence Station Road, Sunnyvale CA 94089
Tel. [408] 734-1290 Fax: [408] 734-2140
1-800-729-7654
First Source International
"The Only Source for Computer Upgrades"

- 50 Day Money Back Guarantee
- 100% compatible in form, fit, & function
- User installable products
- Installation Instructions included
- Toll-free technical support
- Thousands of items in stock
- Manufacturer’s warranties
- Corporate PO’s, APO/FPO’s
- Government & Educational pricing
- International orders welcome
- Special volume pricing
- 24-hour fax line
- Same day shipping
- Overnight delivery available
- VISA, MC, AMEX, & Discover accepted
- No surcharge on credit cards

Call for any items not listed
We’ll meet or beat any advertised price

Toll free from anywhere in the United States or Canada
800/336-9866

International
714/588-9886
Facsimile
714/588-9872

Business Hours
Monday-Friday, 8AM-5PM
Saturday, 10AM-3PM, P.S.T.

First Source International, Inc.
36 Argonaut, Suite 140
Aliso Viejo, California 92656 USA

Terms & Conditions

Ordering: Products are new, unless otherwise noted. All products are guaranteed against defects in material and workmanship for a period of ninety (90) days from date of shipment. If a product is returned to First Source International, Inc. in new condition within the ninety (90) day return period, a return authorization must be obtained, and all returns are subject to a 20% restocking fee. First Source International, Inc. reserves the right to refuse any return that is not in new condition or that is returned without a return authorization. While every effort is made to ensure that the information on this catalog is current, First Source International, Inc. reserves the right to change product specifications, pricing, or availability at any time without notice. All products are subject to availability. Prices and shipping charges are subject to change without notice. Prices quoted are in U.S. dollars. For products that are not available at the time of order, the customer will be notified. Products are shipped via UPS Ground unless otherwise specified.

Mail orders to:
First Source International, Inc.
36 Argonaut, Suite 140
Aliso Viejo, California 92656 USA

The Only Source for Computer Upgrades

CALL THE UPGRADE EXPERTS TOLL FREE 800/336-9866
Windows, Netware, Unix and other high-end applications need a SCSI controller that delivers top disk I/O performance and a growth path. Only SmartCache Plus delivers both — and costs no more than less advanced controllers!

As the industry's fastest SCSI controller, SmartCache Plus is the easy choice. It's the smart choice, too — because if your system needs a performance boost, you can transform it from a non-caching host adapter into the world's fastest caching controller! Expandability is so simple: plug-on modules add caching, up to a total of 16MB of cache memory, and disk mirroring!

SmartCache Plus is supported by all major operating systems and applications, and provides connectivity to hundreds of SCSI devices. Reliable, scalable and simple to install, SmartCache Plus breaks your system's disk I/O bottleneck without breaking your budget!
Don't settle for 386SX performance. With 386DX and 486DX power, external keyboard and VGA ports, it is the only computer you will ever need.

HCP Power Notebook Standard Features

- VGA graphics with 32 gray-scale supertwist back-lit LCD screen
- 4 MB RAM installed, total memory capacity is 16 MB
- 120 MB hard disk, 15 ms access time
- 1.44 MB floppy drive
- Three-hour battery
- Carrying case
- Licensed DR-DOS 6.0
- Two serial, one parallel port
- External numeric keypad included
- External VGA and keyboard connections

Optional Features

- Docking station with 2 x 16 bit slots $160
- Auto cigarette adapter $40
- Memory upgrade to 16 MB $380
- Memory upgrade to 8 MB $160
- Hard drive upgrade to 210 MB $200
- Additional battery set $90
- Additional battery charger $30
- Additional AC power adapter $50

Micro-International, Inc.

10850 Seaboard Loop
Houston, Texas 77099

National Sales 800/967-5667 Houston 713/495-9096

Hours: 9:00 a.m. to 5:00 p.m. M-F, 11:00 a.m. to 1 p.m. Sat. (Central Time)

All systems and components include a one-year warranty: 30-day money-back guarantee.

Price reflects cash or credit card payment. Major corporation purchase orders accepted.
CONTROL UP TO **96 PC FILE SERVERS WITH 1 KEYBOARD AND MONITOR USING**...

**COMMANDER**

- Select via Keyboard
- Dual access up to 250 feet away (optional)
- No external power
- Mix PC, PC/XT, PC/AT and PS/2
- "AutoBoot™" Feature boots attached computers without operator intervention
- Shows PC power status

- PS/2 Mouse support available
- Each unit accommodates from 2 to 8 PCs
- Up to 12 units can be cascaded
- Mounting kit available for 19" and 24" rack installation

**Cybex Corporation**
2800-H Bob Wallace Ave.
Huntsville, Alabama 35805
(205) 534-0011
Fax (205) 534-0010

PC, PC/XT, PC/AT and PS/2 are trademarks of International Business Machines Corp.
ACER 486sx - 16MB SIMM (4M X 36) $529.00
32MB SIMM (8M X 36) $1,599.00
AMI EZ-FLEX - 64MB KIT (4 SIMMS) $2,799.00
AMIGA 2000 - 16MB SIMM $469.00
AST BRAVO 486LC - 16MB SIMM $469.00
COMPAQ SystemPro - 32MB MODULE $1,199.00
DELL 486’s - 16MB KIT (2 SIMMS) $538.00
32MB KIT (2 SIMMS) $1,088.00
MAC IIfx - 16MB SIMM $479.00
MAC QUADRA 950 - 16MB SIMM $469.00
MAC IIci, IIcx, IIsi, QUADRA 900 - 16MB SIMM $469.00
MAC QUADRA 700 & SE/30 - 16MB SIMM $529.00
NeXT TURBO - 16MB SIMM $469.00
SUN IPX, ELC - 16MB SIMM $499.00
SUN SPARC SERVER - 256MB KIT CALL

IBM
PS/1 - 2MB $68
4MB $149
M30 - 2MB $79
M378/520/526 - 1MB $45
M55x/65x - 4MB $135
M70-A21, A61,121, 2MB $79
M420,320x, 8MB $269
M576,200-36 - 1MB $135
M90-041 - 1MB $95
M80-111, 121, 311 - 2MB $180
16-BIT OK Exp Board $128
32-BIT OK Exp Board $128

COMPAQ
DP 386/20/20/20E, 25 - 1MB $66
386/16 - 1MB $159
386/20 - 1MB $165
386N/386N/386N/25 - 4MB $135
M-3270 - 4MB $135
386/20/20E, 25S - 1MB $105

HP
Vectra GS-16 - 2MB KIT $129
Vectra 486 - 2MB $229
X-Station 700 Server - 2MB $139
Quadra 700/700 - 4MB $149
Quadra 900/900 - 4MB $169
Quadra 650 - 1MB $129
Quadra 256K V-RAM $27
LC 512K V-RAM $44

APPLE
II SE/20/30 - 1MB $32
Classic - 1MB Exp. Board $54
SE/30/ii/iiSX/iiLC/iiLC & Quadra 700/900 - 4MB $115
Quadra 700/900 - 32MB KIT $129
Quadra 250 - 16MB KIT $55
Quadra 256K V-RAM $27

DELL
325D-P, 333D-P - 1MB $41
420,425,433 - 2MB KIT $82
420,426,458 - 2MB KIT $158
450D, 450DE, 450EG - 2MB KIT $82
Quadra 256K V-RAM $27
LC 512K V-RAM $44

LAPTOPS
AST EXEC. NB - 4MB $119
COMPAQ LTE386 - 4MB $209
MAC POWERBOOK - 2MB $401
NEC P-500, 386 - 4MB $200
MAC QUADRA 700, SE/30 - 4MB $200

PRINTERS
EPSON 3000P - 4MB $229
HP 6200LJ - 4MB $229
OKIDATA 400 - 2MB $229

OTHER MEMORIES AVAILABLE:
ACER, ALTIMA, APPLE, AST, CHAPLET, COMPAQ, DELL, EPSON, EVEREX, HP, LEADING EDGE, IBM, NEC, NCR, OKIDATA, PACKARD-BELL, PANASONIC, PHILIPS, SAMPO, SHARP, SILEN GRAPHICS, SUN MICROSYSTEMS, TANDON, TI, TOSHIBA, TULIP AND ZENITH.

CALL FOR OUR COMPLETE CATALOG
TERMS: C.O.D., CASH, VISA OR MASTERCARD.
COMPANY AND UNIVERSITY P.O.'S ACCEPTED UPON CREDIT APPROVAL.
414 CLOVERLEAF DR., UNIT B, BALDWIN PARK, CA 91706
TEL. (818)855-5688 FAX (818)855-5687

ALL PRODUCT NAMES, TRADEMARKS AND REGISTERED TRADEMARKS ARE THE PROPERTY OF THEIR RESPECTIVE COMPANIES.
YES! I am interested in learning more about the advantages of TOSHIBA products.

Name____________________ Title____________________

Company____________________ Phone____________________

Address____________________

City____________________ City____________________ Zip____________________

☐ I am a Manchester Customer
  my Salesperson is ____________________________

☐ I am not yet a Manchester Customer.

☐ Have a Salesperson call right away.

☐ I am specifically interested in:

__________________________________________________________

__________________________________________________________

☐ Send more information on your full line of computer supplies and equipment.
TOSHIBA Satellite™
T1800 SERIES

Toshiba has launched a new generation of notebook computers for the value-conscious portable computer user. The economy of the Satellite Series is the result of Toshiba's expertise and the successful integration of their award-winning designs. The Satellite T1800 Series represents a secure portable computer investment because it is Toshiba designed, built, and backed... with quality and reliability second to none.

CHOOSE THE COMPUTER FOR YOUR NEEDS

**T1800**
- i366SX/20 Processor with 9.5” SideLit 64-Gray-Scale LCD, 2MB RAM, & 60MB Hard Drive

**T1850**
- i366SX/25 Processor with 9.5” SideLit 64-Gray-Scale LCD, 4MB RAM, & either 80MB or 120MB Hard Drive

**T1850C**
- i366SX/25 Processor with 9.5” SideLit Ultra-STN Color LCD, 4MB RAM, & either 80MB or 120MB Hard Drive. (Shown above)

INCLUDED FEATURES OF THE T1800 SERIES:
- Ultra-Thin High-Resolution Screens
- Built-In 1.44MB Floppy Drive
- Ergonomic 82-Key Keyboard
- NiCad Battery Technology
- MaxTime Power Management System
- CPU Sleep Mode
- AutoResume Electric Bookmark
- AutoSave (Protects against Data Loss)
- Wide Range of Accessories

SYSTEMS INTEGRATION
- NETWORKING
- CONNECTIVITY
- RISC/UNIX
- CAD/CAM

Authorized TOSHIBA Dealer & Service Center
MANCHESTER EQUIPMENT COMPANY, INC.
"The Computer Supply and Equipment Experts"

50 MARCUS BLVD. • HAUPPAUGE, NY 11788 • (516) 435-1199 • (212) 629-6677
New York City: (212) 629-6969 • Boca Raton: (407) 241-7900 • Tampa: (813) 962-8088 • Boston: (617) 455-8300

Circle 553 on Inquiry Card.
ONE YEAR NATIONWIDE ON-SITE SERVICE

SYSTEMS INCLUDE:

- 120 Meg hard disk (14.5 ms)
- 1.44 Meg floppy drive
- 3.5 Meg floppy drive
- SVGA XGA X 256 .28 14" color monitor
- SVGA Card (Trident) 1 Meg
- 220 Watt desktop or mini tower
- 2 serial, 1 parallel, 1 game, IDE 2HD/2FD
- 101-Key Enhanced keyboard
- 1 year parts and 5 years labor

FCC B and UL Approved

<table>
<thead>
<tr>
<th>Processor</th>
<th>Cache</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>386DX 40</td>
<td>64K</td>
<td>1200</td>
</tr>
<tr>
<td>486DX 33</td>
<td>256K</td>
<td>1600</td>
</tr>
<tr>
<td>486DX2 50</td>
<td>256K</td>
<td>1650</td>
</tr>
<tr>
<td>386DX 40</td>
<td>256K</td>
<td>1825</td>
</tr>
<tr>
<td>486DX2 66</td>
<td>256K</td>
<td>1800</td>
</tr>
</tbody>
</table>

386DX OWNERS
MAKE YOUR 386DX RUN 50% FASTER
JUST CHANGE THE CPU CHIP TO A CYRIX

486DXLPC
33 MHz
$225

One Hollywood Drive
North Grafton, MA
(508) 839-3289
FAX (508) 839-6236
(800) 685-3981

Hours: Monday-Friday: 10am-10pm
Saturday: 10am-6pm
Sunday: Noon-6pm
Join the thousands of satisfied customers who enjoy our combination of price, service, and speed of delivery.

KENOSHA COMPUTER CENTER
SALES LINE OUTSIDE WISCONSIN
1-800-255-2989
Shipping, customer service & technical assistance call 414-697-9595 • Fax 414-697-0620
VISA, MASTERCARD, AMERICAN EXPRESS ACCEPTED

HEWLETT-PACKARD

PLOTTERS & SUMMAGRAPHICS

DMP-52 C&D 1 Pen .............. $1979
DMP-161 A to D 8 Pen .......... $2749

Roll Feed .............................. $4749
Summasketch II 12x12 .......... $279
Summasketch II 12x18 .......... $479

DMP-162R A to E 8 Pen

Canon

B.J. 10 EX ........................ $249
B.J. 10 EX, 360 DPI, 37K Buffer, 142 CPS, 5 fonts, IBM & Epson Emulation

Canon Emulation LQ2550, 600 CPS, 248 CPS, 360 DPI, cut sheet feeder, IBM EMULATION

Canon Emulation BJ 300, 248 CPS, 360 DPI, cut sheet feeder, Epson & IBM Emulation

SOFTWARE

Lotus 2.4/3.1 ........................ $329/$379
Microsoft Word for Windows .... $299
Microsoft ... 

TRIPPLITE

BATTERY BACKUP & UPS AMERICAN

250/400 ................................ $109/$165
500/800/1000 ....................... $199/$239
SMART UPS ........................ $309

MONITORS

Mitsubishi EGA ........................ $239
Mitsubishi Diamond Pro 13" ..... $119
Mitsubishi HL 8959 20" ....... $179
NEC MultiSync IX FSX .......... $129
NEC MultiSync IV FXG ......... $179
NEC MultiSync VXG ............... $179
NEC 6FG ................................ $219

GRAPHICS CARDS

ATI VGA Wonder XL 24 1MB $149
ATI Graphics Ultra 1MB $179

TRADEMARKS & TRADESAERVICES

All trademarks are the property of their respective owners.

No Surcharge on MasterCard or Visa!

KENOSHA COMPUTER CENTER is now in its 6th year!
## BASIC SYSTEM

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>486-50 EISA</td>
<td>$1,099</td>
<td>$1,149</td>
<td>$1,156</td>
<td>$1,159</td>
<td>$1,279</td>
<td>$1,939</td>
</tr>
<tr>
<td>486-33 EISA</td>
<td>$839</td>
<td>$1,239</td>
<td>$1,309</td>
<td>$1,309</td>
<td>$1,479</td>
<td>$1,679</td>
</tr>
<tr>
<td>486-66 DX2</td>
<td>$979</td>
<td>$1,379</td>
<td>$1,449</td>
<td>$1,459</td>
<td>$1,619</td>
<td>$1,819</td>
</tr>
<tr>
<td>486-50 Local Bus</td>
<td>$949</td>
<td>$1,349</td>
<td>$1,419</td>
<td>$1,509</td>
<td>$1,589</td>
<td>$1,789</td>
</tr>
<tr>
<td>486-33 Local Bus</td>
<td>$719</td>
<td>$1,119</td>
<td>$1,189</td>
<td>$1,279</td>
<td>$1,359</td>
<td>$1,559</td>
</tr>
<tr>
<td>486-50 ISA</td>
<td>$919</td>
<td>$1,319</td>
<td>$1,389</td>
<td>$1,479</td>
<td>$1,559</td>
<td>$1,759</td>
</tr>
<tr>
<td>486-33 ISA</td>
<td>$689</td>
<td>$1,089</td>
<td>$1,159</td>
<td>$1,249</td>
<td>$1,329</td>
<td>$1,529</td>
</tr>
<tr>
<td>486-25 SX</td>
<td>$439</td>
<td>$839</td>
<td>$908</td>
<td>$999</td>
<td>$1,079</td>
<td>$1,279</td>
</tr>
<tr>
<td>386-33/40</td>
<td>$399</td>
<td>$749</td>
<td>$869</td>
<td>$959</td>
<td>$1,039</td>
<td>$1,239</td>
</tr>
<tr>
<td>386-33SX</td>
<td>$309</td>
<td>$700</td>
<td>$779</td>
<td>$869</td>
<td>$949</td>
<td>$1,149</td>
</tr>
</tbody>
</table>

Basic Systems include: ~ Motherboard & CPU ~ 101 Enhanced Keyboard ~ 1.3 Meg or 1.44 Meg Floppy Drive ~ 2 Hard/2 Floppy IDE Controller ~ 2 Serial/1 Parallel/1 Game Ports ~ Internal Clock Calendar ~ Coprocessor Socket ~

---

**Why Ultra**

Satisfied Government & Corporate Customers: ~ Pencaps ~ General Electric ~ Melin Bier ~ Sigma Software.

No hassle return Policy: Name brand Parts ~ Test ~ Refurb.: ~ NEC.

Knowledgeable Sales and Technical Personnel.

---

**PRINTERS**

- HP LaserJet 6P $455
- DECwriter 500 $595
- ESP 1150 $189
- ESP 1750 $229
- ESP 2420 $299
- PDS 2820 $299

**VIDEO CARDS**

- MGA/EGA $11
- 16K/32K/64K $59
- Speeder II/IIA $199
- Speeder IIIP/IV $299
- Speeder IIIS $399
- Speeder IIOP/IV $499

**MOTHERBOARDS**

- NEC-36 $110
- NEC-48 $110
- NEC-60 $110
- NEC-72 $110
- NEC-84 $110

**TAPE BACK-UPS**

- 1000F Colorado Tape Back-Up $168

**TOP Options**

- 14" Monitor $168
- 14" Monitor $168
- 14" Monitor $168

**MONITORS**

- 14" Monitor (TFT) $168
- 14" Monitor (TFT) $168
- 14" Monitor (TFT) $168

**NETWORKING**

- Novell Netware 3.12 $600
- Novell Netware 3.12 $600
- Novell Netware 3.12 $600
- Novell Netware 3.12 $600
- Novell Netware 3.12 $600

**BATTERY BACK-UPS**

- 1000F Colorado Battery Back-Up $168

**MEMORY**

- 1MB 50NS SDRAM $47
- 2MB 50NS SDRAM $87
- 4MB 50NS SDRAM $127

**CD ROMS/MULTIMEDIA**

- CD ROMS/MULTIMEDIA $178
- CD ROMS/MULTIMEDIA $178
- CD ROMS/MULTIMEDIA $178

**SCANNERS**

- Canon 650 $49
- Canon 650 $49
- Canon 650 $49

**MODEMS**

- 28800 Modem $125
- 28800 Modem $125
- 28800 Modem $125

---

**CASES W/POWER SUP**

- IBM Model 6280 $55
- IBM Model 6280 $55
- IBM Model 6280 $55

---

**HARD DRIVES**

- 1/1.44 MB FD $59
- 40 MB IDE $166
- 80 MB IDE $265
- 160 MB IDE $377
- 320 MB IDE $723

---

Prices subject to change without notice. All returns subject to 15% restocking fee and must be accompanied by a MA number within 30 days. Shipping, insurance & COD charges are extra, non-refundable. All prices reflect a 3% discount for cash. Ultra Computers is not responsible for typographical or photographic errors. $3.00 charge for orders under $100.00.
Home
Is Where The
Heart Stops.

Moving can be such a harrowing experience. Especially when you’re the sole inheritor of the bloodcurdling Winthrop House.

Lucky you. For the past 400 years, your evil ancestors have been planning a housewarming party just for you. And if they have it their way, this is one party you won’t be leaving.

In this piece of unreal estate, you’ll explore up to 400 terror-hidden rooms in a desperate struggle to stay alive. You’ll encounter puzzles, magical items, and forbidden books. And you’ll meet the hideous hosts who know what evil forces are behind this nightmare.

Can you take the tension? Will your magic combat skills work against loathsome gargoyles or death leeches?

Will your new house drive you completely insane?

All you know is that time is running out. The heavens are aligning. And there’s a lot of housecleaning to be done.

The Legacy: Realm of Terror™ from MicroProse. Proof that there’s no place like home. At least not in this world.

Spine-tingling graphics will turn you chalk-white with horror!

Hair-raising combat with grotesque creatures!

Stupefying stumpers in surreal rooms!

To get our free catalog, call 1-800-879-PLAY.
(Mon.-Fri., 8:30 am-5:00 pm EST)

Or fill out the coupon and mail it to: MicroProse Software, Inc.
180 Lakefront Drive • Dept. D-10 • Hunt Valley, MD 21030-2245

Name ____________________________
Address ____________________________
City ____________________________ State _______ Zip _______

Actual Screen Shots May Vary

MicroProse
Entertainment Software
Seriously Fun Software

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.
MEMORY ... YOU JUST CAN'T DO WITHOUT IT.

Picture this:
You bought a new software package. You try it out on your computer and soon find yourself working for hours on a sophisticated graphic design. While scrolling through your worksheet, it feels like you are moving through pudding. Your hard disk has a tough time trying to catch up. You then try to print, but the laser printer's buffer is full. You reset it, try again, and find that it spits out only part of your beautiful graphic....

No problem!
We'll take it from here. With our JetRam™ line that supports the leading brands of laser printers and PcRam™ line that upgrades your Notebook, Laptop or Desktop computers, Transcend can help solve your memory problems.

What you get from our memory upgrades
- Life time warranty on all our products
- Full memory lines support a variety of brand names of laser printers and PCs
- High quality at a reasonable price
- Easy-to-install

Office hours: 6:00 a.m. to 6:00 p.m. Mon. to Fri.
"You order in the morning, we will ship in the afternoon."

Transcend Information Inc.
104 Exchange Place,
Pomona, CA 91768 U.S.A.
TEL: (909) 598-5500
FAX: (909) 598-5050, (909) 598-6050

3Fl., No. 465, Chung Hsiao East Road,
Sec. 6, Taipei, Taiwan, R.O.C.
TEL: (886) 2-7881000
FAX: (886) 2-7881919, 7889191

* All brand names are registered trademarks of their respective owners.

You Supplier, Your Partner,
Your Friend.

258 BYTE • FEBRUARY 1993

Circle 187 on Inquiry Card (RESELLERS: 188).
So the novelty of flying wore off a long time ago. Cancel those reservations and strap yourself into the cockpit of the F-15 Strike Eagle® III jet fighter computer game. This is flying as it should be. Slicing through war theaters around the world. Blasting enemy fighters to smithereens with high-tech missiles.

Devastating strategic targets in dangerous bombing runs.
Performing fantastic aerial aerobics.
And dogfighting against a friend via modem. All brought to life by dazzling, state-of-the-art graphics. Sure, it’s not like flying first class.

But when’s the last time you had fun flying first class?

F-15 Strike Eagle III from MicroProse.
To get your copy, visit your favorite computer game retailer today.

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.
Available for IBM-PC/Compatibles.
REX NEBULAR IS FOR HIRE!

AND THE SPACEWAYS WILL NEVER BE THE SAME!

Sure, he's for hire. But if he doesn't pull off this job, Rex Nebular's reputation as an interstellar adventurer and womanizer will take a bruising. If that's still possible.

All he has to do is retrieve a priceless vase for a really ticked-off Colonel Stone. It should be easy... NOT!

Especially when this Cosmic Gender Bender gig has enough traps to send Rex to his grave a thousand times over.

Rex will have to locate a cloaked planet. Survive the grotesque Gender Bender machine. Negotiate the perils of a vast underwater world. And tear himself away from legions of sex-starved aliens. Some of whom would like nothing better than to use our hero as breeding stock!

And Rex thought women only wanted him for his mind!

Save Rex Nebular from himself. And save the universe from Rex Nebular. Get your copy of Rex Nebular And The Cosmic Gender Bender today at your favorite retailer.

- STIMULATING state-of-the-art graphics and animation!

- Thousands of MIND-BENDING PUZZLES TO UNLOCK!

- TITILLATING rotoscoped art!

- EASY, HARD, and ADVANCED modes!

- AROUSING INTUITIVE INTERFACE light years ahead of any other!

To get our free catalog, call 1-800-879-PLAY.
(Mon.-Fri. 8:30 am-5:00 pm EST.)

Or fill out the coupon and mail it to: MicroProse Software, Inc.
180 Lakefront Drive • Dept. D-10 • Hunt Valley, MD 21030-2245

Name
Address
City State Zip
Telephone ( )

© 1992 MicroProse Software, Inc. ALL RIGHTS RESERVED.
Everyone makes claims. We make sure.

When the industry wants product testing taken to the nth degree, they take it to NSTL.

In every field, one name sets the standard. In microcomputer testing, the name is NSTL, the leading independent testing lab.

The NSTL compatibility certification seal on a product says that it withstood the toughest lab in the industry — and it's ready for your business.

The seal saves you a lot of comparison and guesswork. It says you'll find the product compatible with a wide range of business applications and hardware. It helps you make the right choice.

Real-world testing for real-world use.

Beyond compatibility testing, we access nearly every conceivable problem — from engineering-level hardware bugs to the everyday usability of business software.

And we test with the end-user in mind, in a real-world environment, just the way your staff uses equipment. Except our trials are more punishing.

Our publications, and others that publish our work.

In a separate facility we also do comparison testing for our own Ratings Reports: Software Digest®, PC Digest® and LAN Reporter®. They're read by people who purchase an average of more than $500,000 in microcomputer hardware and software annually.

And because of the respect we've earned, some of the industry's leading publications, like Data Communications, LAN Times, Unix World and Datapro Research Group publish our test results.

Look for the NSTL seal and be sure.

Experts rely on the NSTL name: now you can, too. The final test of a product is its compatibility in a business environment. The NSTL mark tells you it's already met that test. Look for it when you compare products.
## SOFTWARE LIQUIDATION

**WORDSTAR**

Wordin 6.0 or Wordstar 2000 Basic 3.5

This is not an original. There are some words under selling for $0.

We have found a small error.

**FAX ORDER SERVICE COST**

**SALES**

- 7.0 Upgrades $14

**HARD DRIVE SALE**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST32162</td>
<td>2GB</td>
<td>ST32262</td>
<td>2GB</td>
</tr>
<tr>
<td>ST32164</td>
<td>2GB</td>
<td>ST32264</td>
<td>2GB</td>
</tr>
<tr>
<td>ST32168</td>
<td>2GB</td>
<td>ST32268</td>
<td>2GB</td>
</tr>
<tr>
<td>ST32170</td>
<td>2GB</td>
<td>ST32270</td>
<td>2GB</td>
</tr>
<tr>
<td>ST32256</td>
<td>2GB</td>
<td>ST32258</td>
<td>2GB</td>
</tr>
</tbody>
</table>

**CONNER**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP3086</td>
<td>80MB</td>
<td>CP3296</td>
<td>80MB</td>
</tr>
<tr>
<td>CP3286</td>
<td>80MB</td>
<td>CP3266</td>
<td>80MB</td>
</tr>
<tr>
<td>CP3306</td>
<td>80MB</td>
<td>CP3263</td>
<td>80MB</td>
</tr>
<tr>
<td>CP3246</td>
<td>80MB</td>
<td>CP3283</td>
<td>80MB</td>
</tr>
<tr>
<td>CP3256</td>
<td>80MB</td>
<td>CP3293</td>
<td>80MB</td>
</tr>
</tbody>
</table>

**Maxtor**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>E56361</td>
<td>1GB</td>
<td>E56362</td>
<td>1GB</td>
</tr>
<tr>
<td>E56363</td>
<td>1GB</td>
<td>E56364</td>
<td>1GB</td>
</tr>
<tr>
<td>E56365</td>
<td>1GB</td>
<td>E56369</td>
<td>1GB</td>
</tr>
<tr>
<td>E56372</td>
<td>1GB</td>
<td>E56373</td>
<td>1GB</td>
</tr>
<tr>
<td>E56374</td>
<td>1GB</td>
<td>E56375</td>
<td>1GB</td>
</tr>
</tbody>
</table>

**FUSION**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>65120</td>
<td>1GB</td>
<td>65121</td>
<td>1GB</td>
</tr>
<tr>
<td>65122</td>
<td>1GB</td>
<td>65123</td>
<td>1GB</td>
</tr>
<tr>
<td>65126</td>
<td>1GB</td>
<td>65127</td>
<td>1GB</td>
</tr>
</tbody>
</table>

**Fujitsu**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM701916</td>
<td>1GB</td>
<td>CM701917</td>
<td>1GB</td>
</tr>
<tr>
<td>CM701919</td>
<td>1GB</td>
<td>CM701920</td>
<td>1GB</td>
</tr>
<tr>
<td>CM701921</td>
<td>1GB</td>
<td>CM701922</td>
<td>1GB</td>
</tr>
</tbody>
</table>

**Micronals**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>33184</td>
<td>1GB</td>
<td>33185</td>
<td>1GB</td>
</tr>
<tr>
<td>33186</td>
<td>1GB</td>
<td>33187</td>
<td>1GB</td>
</tr>
<tr>
<td>33188</td>
<td>1GB</td>
<td>33189</td>
<td>1GB</td>
</tr>
</tbody>
</table>

**Fujitsu**

**Hard Drives**

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>33184</td>
<td>1GB</td>
<td>33185</td>
<td>1GB</td>
</tr>
<tr>
<td>33186</td>
<td>1GB</td>
<td>33187</td>
<td>1GB</td>
</tr>
<tr>
<td>33188</td>
<td>1GB</td>
<td>33189</td>
<td>1GB</td>
</tr>
</tbody>
</table>

**LAPE Top & Notebook Hard Drives**

<table>
<thead>
<tr>
<th>Size</th>
<th>Model</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>60GB</td>
<td>2.5&quot;</td>
<td>$319</td>
</tr>
<tr>
<td>130GB</td>
<td>2.5&quot;</td>
<td>$499</td>
</tr>
</tbody>
</table>

**Floppy Drives**

| 5.25"          | 3.5"          |
| 1.44MB         | 1.2MB         |
| 1.2MB          | 1.44MB        |

**Drive Controllers**

- 9E $36
- 9E $45
- 9E $85
- 9E $95
- 9E $125
- 9E $145
- 9E $175
- 9E $205
- 9E $235

**CD-ROM, 52x/32x/52x**

<table>
<thead>
<tr>
<th>52x/32x/52x</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>52x</td>
<td>52x</td>
</tr>
<tr>
<td>32x</td>
<td>32x</td>
</tr>
<tr>
<td>52x</td>
<td>52x</td>
</tr>
</tbody>
</table>

**Special Sale!**

**Software**

- Wordstar 6.0 or 88
- Wordstar Volume Control
- RCA JochfQr Stereo Audio Output
- Daiychain
- Microwave
- Toolworl
- Wordstar 6.0 or Wordstar 2000

- **88SIT 4 Floppy Drive** $9
- **CP3010A** $299
- **532MB 80M8** $58
- **CP3020** $209
- **ST41200N** $1499
- **1624HHH** $1099
- **LAPTOP** $899
- **2623A** $999
- **2652S** $1759

**Seagate ST4766N**

- SCSI 600MB, 15MS, 51/4" FH
- Only $899.00 while supplies last

**16 Bit Memory Board**

- Hardware 4.0 IBM Microchannel - 5YR WARRANTY
- ORO 4MB $129
- ORO 8MB $252
- ORO 16MB $569

**Software**

- Wordstar 6.0 or 88
- Wordstar Volume Control
- RCA JochfQr Stereo Audio Output
- Daiychain

- **88SIT 4 Floppy Drive** $9
- **CP3010A** $299
- **532MB 80M8** $58
- **CP3020** $209
- **ST41200N** $1499
- **1624HHH** $1099
- **LAPTOP** $899
- **2623A** $999
- **2652S** $1759
Circle 168 on Inquiry Card.

**TOLL-FREE TECHNICAL SUPPORT**
Buffalo Technical Support provides friendly, effective assistance for installation and operation.

**TOLL-FREE APPLICATION ADVICE**
Our knowledgeable staff will help you select the right Buffalo Products, Inc. products to fit your needs.

**ONE YEAR WARRANTY**

**45 DAY MONEY-BACK GUARANTEE**

**BUFFALO**

US AND CANADA TOLL-FREE
1-800-345-2356
(503) 585-3414
FAX (503) 585-4505
Buffalo Products, Inc.
2805 19th St. SE, Salem, OR 97302
Response Code: 23HW3

BUFFALO is a registered trademark of Meleo, Inc.

WHOLESALERS, INC.
P.O. Box 450, Orchard Park, NY 14127
Hours: 8:00 am to 6:00 pm Mon-Fri
Customer Service: 716-647-6267
Fax: 716-637-2108

FEBRUARY 1993 • BYTE 263

---

**PRINTER SHARING SOLUTIONS**

**EASY INSTALLATION AND OPERATION**

Standard parallel interfaces make installation simple, and since the HWP supports both software and push-button control, it is easy and convenient to use.

**FAST DATA TRANSFER**

The HWP transfers data at speeds up to 180,000 characters per second. It can buffer large jobs sent from your PC faster than your printer can print them. Your PC can go on to the next task, whether or not a printer is available to it.

**AUTOMATIC FUNCTIONS**

Input switching and buffering are automatic, so with the HWP installed all your PCs print quickly and easily.

**LARGE BUFFER CAPACITY**

Buffalo H Series boxes offer buffer expandability from 256 KB up to 16MB to handle even the largest graphics projects.

**OTHER ALTERNATIVES**

Buffalo carries a complete line of computer resource sharing products, priced from $175.

**HWP256** $295

---

**You Can Rely on Ralin For all Your PC System Upgrades!**

**MODEM UPGRADES**

Zoom Telephonics

All Zoom modems are backed by a 7-year warranty and are made in the USA.

- **2400 bps w/ v.42bis and MNP 2-5**
  - (AMC) (AMX) $49.00
  - (AFX) (AXF) $59.95
- **2400 bps w/ v.42bis and MNP 2-5**
  - 9600 send & 4800 receive Fax $65.00
  - 79.95
- **9600 bps modem w/ v.32, v.42bis, MNP2-5**
  - (VI-V32) (VX-V32) $199.00
  - (VFX-V32) $199.00
- **14,400 bps modem w/ v.32bis, v.42bis, MNP 2-5 and 9600 bps send/receive Fax**
  - (VFP-V32bis*) (VFX-V32bis) $225.00
  - $269.00
- **2400 bps modem w/ v.42bis and MNP 2-5, 9600 bps send and 4800 bps receive Fax**
  - PKT Pocket/Fax Modem $99.00

*WINFAX software option available for $15 if purchased with VFP-V32bis or VFX-V32bis modem.

Call a corporate sales expert today and find out how Ralin can maximize your purchasing dollars by upgrading your existing computer equipment.

Ralin stocks:
- Motherboards
- SIMM Memory
- Controllers
- Printers
- Monitors
- Hard Drives
- MPC Products
- Computer Cases
- Keyboards and much more

**CALL 1-800-752-9512**

---

**Warranty**

- **45 Day Money-Back Guarantee**
- **1 Year Warranty**
- **ONE YEAR WARRANTY**

**WHOLESALERS, INC.**
P.O. Box 450, Orchard Park, NY 14127
Hours: 8:00 am to 6:00 pm Mon-Fri
Customer Service: 716-647-6267
Fax: 716-674-2108

FEBRUARY 1993 • BYTE 263
For Today's Hottest Authors on the Hottest Topics, Choose Osborne Computer Books

by John C. Dvorak and Nick Anis
$39.95 Book/Disk
ISBN: 0-07-881835-4

Jamsa's 1001 DOS & PC Tips
by Kris Jamsa
$39.95 Book/Disk
ISBN: 0-07-881821-4

Dvorak's Inside Track to DOS & PC Performance
by John C. Dvorak and Nick Anis
$39.95 Book/Disk

Hot Links: A Guide to Linking Computers
by Mark Eppley and David Hakala
$29.95 Book/Disk

Get the inside scoop on the best ways to maximize your computer's performance from Osborne's top authors. You'll find practical, real-world discussions in these books along with exclusive tips and insights. PLUS, in the book/disk packages, you'll also find software that is new and unavailable elsewhere.

Available now at the following stores:

Waldenbooks
Crown Books
Waldensoftware
SOFTWARE ETC

Osborne
Copyright © 1993 McGraw-Hill, Inc.
CASE·200A Super Deluxe Upright $349.95
CASE·100A $99.95
CASE·130 Mid-upright case $99.95
PS·300TW 300W power supply $149.95
PS·250TW 250W power supply $129.95
PS·200TW 200W power supply $119.95
MOD·HIC $149.95

POWER SUPPLIES
- U/L approved
- 110/220VAC, 50/60Hz

CASE·1024A $99.95
CASE·1024B $99.95
CASE·1024C $99.95

MOTHERBOARDS
- Modular circuit technology
- 25MHz Intel 80386SX CPU
- Expandable to 16Mb on-board
- Uses 256K, 1MB or 4MB x 8/16 SIMMs (OK installed)
- Six 16-bit and two 8-bit slots

NEW LOWER PRICE!
- $199.95

PORTABLE 4-PORT FAX
- 14,400/1200 baud, 3.5" floppy, 4MB RAM
- 4MB drive, 3.5" drive, Beige
- 120Mb 20ms 3.5" IDE
- 80Mb 20ms 3.5" IDE
- 40Mb 20ms 3.5" IDE
- 2MB 20ms 3.5" IDE
- 1MB 20ms 3.5" IDE

POWER INCREASER
- Post code display card
- Displays power on self-test code
- Works when software won’t even boot

EPROM ERASER $39.95
- Quickly and simultaneously erases up to 4 standard EPROMs

EPROM PROGRAMMER $199.95
- Programs devices up to 256K bits, plus 27C100, 27C161, 27C401, 27C2001, 27C5001 and more
- Includes dedicated 8-bit 8086 and 82C2000B/27C2000B/27C5001
- ZIF socket accepts 0.96W DIP ICs to 32 pins

MATH CO-PROCESSORS
- For PCs, ROM images

CALL FOR YOUR FREE JDR CATALOG TODAY!
- FOR PC'S, SOFTWARE, MONITORS, DISK DRIVES, KEYBOARDS, MODEMS, CABLES, CONNECTORS, ICs, COMPONENTS, PROGRAMMERS, TEST EQUIPMENT, TOOLS & MORE!
Lost for the write word?

Get it right with

COLLINS ON-LINE v2

French, German, Italian & Spanish bilingual dictionaries for your PC.

Over 40,000 references, 70,000 translations drawn from contemporary use.

FEATURES INCLUDE:

- **TSR** - memory resident so it can be used with most word processors for MS-DOS.
- **Look-up** - enables you to find words in the dictionary.
- **Screen-read** - reads words in your document automatically for quick and accurate translation.
- **Annotate** - allows you to create your own specialized glossaries for use with Collins' world renowned bilingual dictionaries.

**English version**

(LiveTech Inc Inc)

1015 South Dowell Bldg.
Orem, Utah 84058 USA
Tel: +1 (801) 226-2525
Fax: +1 (801) 226-7701
Email: info@liverock.com

**German version**

(LiveTech Inc Inc)

1015 South Dowell Bldg.
Orem, Utah 84058 USA
Tel: +1 (801) 226-2525
Fax: +1 (801) 226-7701
Email: info@liverock.com

**French version**

(LiveTech Inc Inc)

1015 South Dowell Bldg.
Orem, Utah 84058 USA
Tel: +1 (801) 226-2525
Fax: +1 (801) 226-7701
Email: info@liverock.com

Circle 371 on Inquiry Card.

SSD-2HD Intelligent Solid-State Disk

- 1.44MB max. FLASH/EPROM Disk w/auto-boot backup
- 1.44MB max. SRAM Disk w/battery backup
- Auto-sense installed FLASH/EPROM in memory types
- Auto-configurable Solid State Disk Drive
- Software protection key (PARAKEY) designed to protect a specified software application from unauthorized use.

Circle 367 on Inquiry Card (RESELLERS: 368).

ROMDISK™

Solid State Disk and Drive Emulators

- Proven Performance! For OEM/Military, Embedded Systems, Diskless/High Performance PC's, CAD/CAM, Industrial Control, Medical, POS, LAN's, etc.
- **High Capacity Models** (PC/AT).
- **Low Cost Models** (FERO, E/S/Special OEM).
- **Dual Mode Emulation Models** (PC, PCM2, PCE/2).
- **Autoboot Capabilities**, all models.
- **MICRODOS/DOS/OS:Venus OS Support**.
- **NEW**! PCM1A models (PCM, PCM2) and accessories!

**CURTIS, INC.**

Industry Leader in Disk and Drive Emulation Products

418 W. County Rd. D
St. Paul, MN 55112
612/631-9512 612/631-9508

Circle 338 on Inquiry Card.

Parallel Processing

For the professional, student or hobbyist who wants to come up to speed with parallel processing. All kits include one or more 20-MHz 32-bit transputer processors, each with 1MB of DRAM & Occam2, C, and assembler; examples and demos & complete set of manuals & schematics. Requires IBM-compatible PC.

**4 Processors: $1,284 1 Processor: $396**

The Transputer Education Kit is outstanding. You would be hard pressed to find as valuable and inexpensive a tool.

R. Eckhouse, IEEE Computer, Sept. 92, page 97

Computer System Architects

15 N.100 E., #100
Provo, Utah 84606
Tel: 800-753-4CSA or 801-374-2300
Fax: 801-374-2306

Circle 333 on Inquiry Card.

PC/AT Four Port Com. Coprocessor

- **GMM Sync4/CCP™**
  - High Performance 16 MHZ 16 bit CPU.
  - 8088 & 8086 code compatible.
  - 4 Sync/Async Ports (2 Serial Ports with Full Duplex DMA).
  - Uses Zilog B5230, 85230 SCC chip.
  - 102K Dual Port RAM (STD), 1, 2, or 4 MEG Dual port SRAM - optional.
  - 8 software selectable and sharable Interrupts.
  - 8k, 16k, 32k, 64k Window Size (Programmable).
  - Source Code Debugger Kit Available.

Other PC/AT & PS/2 5330 based products available.

Circle 339 on Inquiry Card.

Light-Speed Serial Communications

PCSS-8FX Intelligent Serial Coprocessor

- Better than 1MB/sec transfer rate.
- No load on Host Processor.
- I/O Mapped - No host memory used.
- NEW! Supports DMA transfer.
- Faster than Dual Port Memory.
- Looks like IBM Unit with Queueing.
- 8 ports per card. RS-232, 422, 485.

Circle 338 on Inquiry Card.

PC/AT on Inquiry Card.

PC/AT on Inquiry Card.
Communication/Networking

**RECYCLE Your PC**

**INFINISTOR** restores your old or obsolete PC. Microprocessor driven, this NEW Interconnect system enables you to use disk drives in your old PC as if they were mounted within your current PC. Your old PC can also access all of your new PC storage devices if it is initialized as the host. The applications of this connectivity medium are limited only by your imagination!

- Drives: A, B, C, D, E, F
- E:
- SLAVE
- Drives O, P, Q, R, S, T

**Basic INFINISTOR Configuration**

- 200K Bytes per second throughput
- Use Hard Disk, Floppies, RAM Cache on slave
- Simple installation of a half card on each end
- Up to three slaves can be connected to each host
- 5 Year Warranty
- $299.00 list price • special Introductory price of $159.95 for host and one slave

**INFINICON**

101 Library Plaza • 15 North 100 East • Provo, UT 84606

SOON TO BE RELEASED! Providing total access of storage devices in your laptop when connected to your desktop. A low cost alternative to docking stations and pocket LAN adaptors. VISA • MasterCard • AMEX

**FREE CATALOG**

Contains 284 pages of quality tools and tool kits, service diagnostics and test equipment for maintenance of computers and communication systems. Also LAN products: cables, taps, connectors, transceivers, repeaters, assemblies, and more. Free shipping, free technical support, 100% guarantee.

Jensen Tools Inc.
7813 S. 46th St., Phoenix, AZ 85044
(602) 968-6231 • Fax (602) 968-6662

**Computer Systems•Data Acquisition•Disk & Optical Drives**

**AT Systems in ROM**

- Single Board Computers
- Run DOS code from ROM
- PC Code compatible
- Large Memory space
- Backplane systems
- Develop code on a PC. Run on your CPU cards with DOS and code in ROM. Use off-the-shelf expansion cards.
- K56: NEC V55 CPU (286eqa), 5 serial, 2 Par. Clock. AT bus, Max 4M Ram. 2M Rom, 1512K NV Sram. $349 (Oem ver).
- K53: V40 CPU, 3 Serial, 2 Par, Clock, Flop, Kbd. $249 (q).

303-444-7737 Fax 303-766-9993

665 Hawthorn Ave., Boulder CO 80304 U.S.A.

**AT Systems in ROM**

**INFINISTOR** restores your old or obsolete PC. Microprocessor driven, this NEW Interconnect system enables you to use disk drives in your old PC as if they were mounted within your current PC. Your old PC can also access all of your new PC storage devices if it is initialized as the host. The applications of this connectivity medium are limited only by your imagination!

- Drives: A, B, C, D, E, F
- E:
- SLAVE
- Drives O, P, Q, R, S, T

**Basic INFINISTOR Configuration**

- 200K Bytes per second throughput
- Use Hard Disk, Floppies, RAM Cache on slave
- Simple installation of a half card on each end
- Up to three slaves can be connected to each host
- 5 Year Warranty
- $299.00 list price • special Introductory price of $159.95 for host and one slave

**INFINICON**

101 Library Plaza • 15 North 100 East • Provo, UT 84606

SOON TO BE RELEASED! Providing total access of storage devices in your laptop when connected to your desktop. A low cost alternative to docking stations and pocket LAN adaptors. VISA • MasterCard • AMEX

**FREE CATALOG**

Contains 284 pages of quality tools and tool kits, service diagnostics and test equipment for maintenance of computers and communication systems. Also LAN products: cables, taps, connectors, transceivers, repeaters, assemblies, and more. Free shipping, free technical support, 100% guarantee.

Jensen Tools Inc.
7813 S. 46th St., Phoenix, AZ 85044
(602) 968-6231 • Fax (602) 968-6662

**Computer Systems•Data Acquisition•Disk & Optical Drives**

**AT Systems in ROM**

- Single Board Computers
- Run DOS code from ROM
- PC Code compatible
- Large Memory space
- Backplane systems
- Develop code on a PC. Run on your CPU cards with DOS and code in ROM. Use off-the-shelf expansion cards.
- K56: NEC V55 CPU (286eqa), 5 serial, 2 Par. Clock. AT bus, Max 4M Ram. 2M Rom, 1512K NV Sram. $349 (Oem ver).
- K53: V40 CPU, 3 Serial, 2 Par, Clock, Flop, Kbd. $249 (q).

303-444-7737 Fax 303-766-9993

665 Hawthorn Ave., Boulder CO 80304 U.S.A.

**Rackmount Solutions**

RACKMOUNT COMPONENTS - 30% PRICE REDUCTION

Rackmount Chassis 19x17x7 $183

Rackmount VGAA Mointor $351

Rackmount Monitor Shelf $113

Rackmount Keyboard Shelf $88

RACKMOUNT PLATFORMS - 30% PRICE REDUCTION

RS/600-3E/EIA $1789

RS/500-60 $814

RS/485-5 $1443

Rackmount Systems includes 3 Rackmount Chassis, 200W Power Supply, Motherboard, 1.068 Memory, IDE, EIC, 2-Par. PC, 1.2MB or 1.44MB Happy Disk Drive, 1 Year Warranty

RACKMOUNT CHASSIS - 15 Models up to 10 Elevation Slots 600 CPU Board - 486, 586, 386x

RACKMOUNT MONITORS - Super VGA and Monochrome

RACKMOUNT CABINET - Modular from 2 to 96" Height

THI VALLEY TECHNOLOGY INC.

2468 Armstrong Street, Livermore CA 94550
(510) 447-2030 FAX: (510) 447-5559

**The Intelligent Solution For Data Acquisition**

DAP 2600a Data Acquisition Processor

**ANALOG I/O**

**DIGITAL I/O**

- Inputs to 321K samples per second
- Simultaneous fast input/output
- FFT and FIR Filtering

Digital Signal Processing at 16 MIPS

20 MHz CPU with DRAM to 1024K

32 MHz DSP with BRAM to 96K

DAP® Operating System

- 100% standard commands
- Custom commands in C

Send for FREE catalog and demo diskette.

Or call us at (206) 453-2345.

**Voice Mail • Telemarketing • Call Processing**

Transform your PC into a multi-line processing command center! Interactively process your sales, inquiries, and messages. Complete package.

Multi-Line (Voice Solution) $950

SINGLE LINE (Bignouth) $295

For Sales or Information:
Call 1-800-685-4884
TALKING TECHNOLOGY, INC.
1123 ATLANTIC AVE. • ALAMEDA, CA 94501

General Technical Services
1-800-818-8188

FEBRUARY 1992 - BYTE - 287
FREEDOM!
We fight for it...even die for it! Fortunately in this case we can have it for less than $30 dollars.
The FREEDOM STATION®
Welcome to the Future of Mouse Computing.
The ultimate accessory for your computer mouse!
A mouse peripheral designed by users, for users, worldwide
BETTER THAN WIRELESS
- No Batteries
- No sluggish response
- No loss of resolution
Professionally designed to rid your mouse cord of that nasty habit of getting caught on everything in sight!

The FREEDOM STATION projects, suspends and locks your mouse cord above the work station. The projection tower enables the cord to freely rotate around the workspace following your mouse as you go about your work. The FREEDOM STATION’s unique freedom of motion lies in the design of the suspension tower. The tower is made of dual balanced flexible compression coils and a projection clip. In order to simulate the feeling of a wireless mouse, the tensile strength, length, height and even the angle of the tower were evaluated and tested for optimum performance.

The FREEDOM STATION includes the suspension tower, cord tip guide, baseframe, cord locking channels and a high quality 10,000.5 proportional reduction.

MS-PRO FREEDOM STATION®
Orders Only 800-452-7546
30-Day Money-back Guarantee if not 100% satisfied. 2 Year Limited Warranty
C.P. Research

Now you can connect your desktop peripherals in one easy step while reducing wear and tear on your interface ports. The CableMate Plus option provides bus expansion for low cost ISA compatible Lapstation expansion systems and both versions are available for Compaq LTE, Toshiba T2200-T6400 and other popular Notebook models. CableMate and Lapstation are available from Axonix direct, and from Authorized Axonix dealers worldwide.

Call Toll Free for Nearest Dealer 1-800-866-9797

Call Toll Free To Order: 1-800-DATALUX
-
VISA, MC, AmX-

Popular Space-Saver Keyboard $98.00
Saves 60% desk space. Footprint 27.3 x 15.2 cm. 100 full travel tactilely responsive keys. Standard left-right spacing for easy touch typing. IBM XT/AT PS/2 compatible. Many language versions available.

Call Toll Free To Order: 1-800-DATALUX

Money Back Guarantee & 1 Yr. Warranty

Circle 357 on Inquiry Card.

Circle 357 on Inquiry Card.

Circle 357 on Inquiry Card.

Circle 357 on Inquiry Card.

Circle 357 on Inquiry Card.
Universal Keypad for Portable Computers

Boost data entry speed, accuracy and convenience with Genovation's Micropad,™ the innovative numeric keypad for portable computers.

TO COMPUTER

Is the unhandy numeric section of your portable computer's keyboard dragging you down?...Give your productivity a boost by using our Micropad. The ergonomically designed Micropad is ideal for spreadsheet and accounting applications that require fast and accurate entry of numeric data.

The Micropad attaches to the parallel port of any MS-DOS computer while providing a clean pass through connection to the printer. Power usage is negligible. Lightweight and compact, the Micropad is fully programmable and is also available with connectors to fit keyboard and serial ports.

TO PRINTER

Memory Superstore... your direct source.

For the absolute best prices on laptop, desktop and workstation memory, call now! 800-800-7056.

For more info on laptop products, please contact:

TOP PC

"we're the notebook company..."

380-mono to 480-color.

7:30AM - 6:00PM

For more information about our complete line of memory products, please contact:

TOP PC International, Inc., 1646 S. Santiago Blvd., Orange, CA 92866. Tel. (714) 436-4130 Fax (714) 436-6025

Circle 378 on Inquiry Card (RESELLERS: 379).
**STAND-ALONE LCD MONITOR**

New Touch Screen Option Available

$995 | This 10" black on white monitor is easy-to-read, yet compact. Resolution is 640x480 for sharp, flicker-free image. Fast response, high refresh rate twisted nematic technology with backlighting provides a bright low screen with a wide viewing angle. The adjustable monitor base is only 29x14 cm. It lets you mount the LCD monitor on vertical surfaces or fold for transport. Comes with 1.5 m cable and controller card. No external power required. IBM AT compatible.

$1,495 | New Touch Screen Option. Capacitive technology from MicroTouch™. Provides high resolution, fast response, all glass scratch proof optically clear touch sensor. Complete with controller and software. DOS Windows compatible.

To Order Call Toll-Free: 1-800-DATALUX

DATALUX

155 Aviation Drive • Winchester, VA 22602

Circle 334 on Inquiry Card.
Programmable Hardware

UNIVERSAL PROGRAMMERS & TESTERS
TUP-400 $745  TUP-300 $575
- Program PLD (PAL, GAL, EPLD, PEEL, MAPL, MAX, MACH..., EPEPROM (Up to 1MB), EPROM, SERIAL, PROM, FLASH, MPU (87XX, 68XX, 68HCXX, PIC16XX, TMS320XX, 25, PSIDXX, HITACHI, NEC...).
- 40 pin DIP socket standard. Expandable to support PLCC (T) SOP, SOIC, OTP, PGA, TSSOP, DIP... with up to 64 pins.
- Tests TTL74, CMOS, 40/45, DRAM, and SRAM.
- Optional EPROM SIMULATION capability.

TUP-400 $745  TUP-300 $575
• Programs PLO (PAL, GAL, EPLD, MAPL, MAX, MACH...), E(E)PROM (Up to 16Mbit), BPROM, SERIAL PROM, FLASH, MPU (87XX, 68XX, 68HCXX, PIC16XX, TMS320XX, 25, PSIDXX, HITACHI, NEC...).
• 40 pin DIP socket standard. Expandable to support PLCC, SOP, SOIC, QFP, PGA, SIM M/S IP... with up to 84 pins.
• Tests TTL74, CMOS, 40/45, DRAM, and SRAM.

• Optional EPROM EMULATION capability.
• Programs up to 8Mbit 32 pin 27xxx devices.
• Supports 28FXXX and 29CXXX.
• Options master and 8 gang sockets are standard.
• Programs 82C200 EPROMs in only 25 seconds on a 286/16 PC.
• Other EPROM PROGRAMMERS available starting at $175.
• Stand-Alone versions available also.

CALL TODAY FOR MORE INFORMATION

Tribal Microsystems Inc.
Tel (510) 623-8859
Fax (510) 623-9925

Circle 358 on Inquiry Card (RESELLERS: 359).

SUPERPRO® now $599 (US only)

Over 2,000 devices, desktop programmer for your IBM PC with high speed & reliability
- Easy to use graphic driven Software.
- Universal programming for 80C51/52/54 devices.
- Supports 28FXXX and 29CXXX.
- One master and 8 gang sockets are standard.
- Programs 82C200 EPROMs in only 25 seconds on a 286/16 PC.
- Optional EPROM PROGRAMMERS available starting at $175.
- Stand-Alone versions available also.

Circle 358 on Inquiry Card (RESELLERS: 359).

Security • Tape Drives

Now you can take it with you.

The Kablit

VANGUARD

Physical Security for

NOTEBOOKS • LAPTOPS • PORTABLES

The VANGUARD secures your computer against theft. More important, it protects the data you put into it no matter where you are:
- OFFICE • HOME • HOTEL • CAR • AIRPORT

Pin Pend

- Installing in seconds...as easy as installing a computer cable.
- Attach to any unused 9 or 25 pin port screws.
- Fits all computers except Macintosh.

List Price • $49.95

Call for complete details.
800-451-7592
413-525-7039

Circle 352 on Inquiry Card (RESELLERS: 353).

COMPUTER PROTECT

COMPUTER SECURITY DEVICE

Innovative device to protect your computer system

- Protects your data from unauthorized copying
- One year hardware warranty, 30 day money back guarantee
- Easy to use Dynamic C®
- Redefines all compatible personal computers and laptops
- Batteries backed memory and time/date clock

Wentek Technology Inc.
12911 Romaro Blvd., Suite 21, Irvine, CA 92618
Tel: (818) 960-8899 Fax: (818) 960-1256

Circle 374 on Inquiry Card.

Now you can take it with you.

The Kablit

VANGUARD

Physical Security for

NOTEBOOKS • LAPTOPS • PORTABLES

The VANGUARD secures your computer against theft. More important, it protects the data you put into it no matter where you are:
- OFFICE • HOME • HOTEL • CAR • AIRPORT

Pin Pend

- Installing in seconds...as easy as installing a computer cable.
- Attach to any unused 9 or 25 pin port screws.
- Fits all computers except Macintosh.

List Price • $49.95

Call for complete details.
800-451-7592
413-525-7039

Circle 352 on Inquiry Card (RESELLERS: 353).

9 Track/3480 Tape Subsystems
1/4" DAT 8mm Optical
New Windows Software Available
- Best Quality
- Lowest Prices
800/1600/3200/6250 BPI
CALL 1-800-859-8856

Laguna Data Systems
23151 Alcalde Drive, Suite B-3, Laguna Hills, CA 92653
Tel: 714-586-3010, Fax: 714-586-5538

Circle 346 on Inquiry Card.
Dealers Wanted

MicroBiz, the nation's leading POS software developer, is currently looking for 200 additional dealers to supplement its nationwide dealer network. The MicroBiz Controller Series is available for the following markets: Retail • Video • Auto Repair • Liquor • Rental • Hair/Nail Salon • Restaurant, Dry Cleaner and more...

Dealer Inquiries Welcome • Call for a FREE catalog French and Spanish versions available

800-637-8268
Fax: (914)425-4598 Ph: (914)425-9500
BBS: (914) 425-6440

Circle 376 on Inquiry Card (RESELLERS: 377).

9-Track for PCs
Mainframe to PC data interchange

Rock solid solutions, rock bottom prices.
Direct from the manufacturer. 1600 & 6250 bpi.
Subsystems include drives and software.
800-729-8725
Since 1980
3480 Now with IDRC!

Ask about 3480 tape drives too

Circle 349 on Inquiry Card.

Desktop 9-Track Tape Subsystem
#1-selling 9-track system on desktop.

Qualstar's low cost 1/2-inch 9-track Streaming tape systems bring full ANSI data interchange to IBM AT, PS/2 or Macintosh, giving your micro the freedom to exchange data files with nearly any mainframe or minicomputer in the world.

Systems include DOS or Xenix compatible software, coupler card and cables. High reliability 1600 or 6250 BPI capability may be used for disk backup as well as data interchange.

Call us today! For details and to order:
Fax (818) 882-4081
Phone (818) 882-5822

©1989 Qualstar Corp.
All product and company names and trademarks are the exclusive property of their respective owners.

Circle 351 on Inquiry Card.

Free Data Acquisition Software Tool

DAQ Designer is a free software tool that helps determine which hardware and software combinations are best for your PC-based data acquisition system. DAQ Designer will (1) ask questions about your application, (2) analyze your answers to determine your system needs, and (3) describe what hardware and software you need to develop your data acquisition system.

National Instruments
6504 Bridge Point Parkway
Austin, TX 78730
(512) 794-0100 • (800) 433-3488

Circle 348 on Inquiry Card.

FLOW CHARTING 3

Powerful new features – for greater speed, flexibility, and ease-of-use!
• Single-page, multi-page or canvas charts – portrait or landscape
• Custom fonts support high resolution laser and 24-pin dot matrix printers
• 35 standard shapes, 10 text fonts
• Suggested retail price: only $250

See your dealer today or, for a "live" interactive demo disk, call: 800-525-0082, ext 1218
International: 408-778-6557, ext 1218
Fax: 408-778-9972

PATTON & PATTON
Software Corporation
Circle 350 on Inquiry Card.
**APL**  Complete APL system $60.


NEW! True Windows 3.1 versions. GUI programming for APL and J

Iverson Software Inc.
33 Major St., Toronto, Ontario, Canada M5S 2K9
Phone (416) 925-6096  Fax (416) 488-7559

Circle 369 on Inquiry Card.

---

**PC Diagnostics and System Information**

**QAPlus**  Over 3 Million users

- New Version 4.7 now includes Reachout Host remote control software and Novi Scan virus detection software
- Both novices and expert PC users can quickly solve common computer problems
- Reports hardware configuration, interrupts, performance benchmarks and more
- Includes LAN features for networked PC support and management

For More information call:
1-800-DIAGSOFT

Also from DiagSoft: QAPlus/WIN for tuning and troubleshooting Windows’ and QAPlus/FE for power-users and service/support professionals.

Available from Egghead Discount Software, Comp USA, Biz Mart, Fry’s Electronics and other fine retailers.

DiagSoft, Inc., 5615 Scotts Valley Drive, Suite 140, Scotts Valley, California 95066 · 1-408-438-8247 · FAX 1-408-438-7113

Suggested Retail: $159.95

Circle 336 on Inquiry Card.

---

**Programming for Microsoft Windows**

Doesn’t have to be a Pane for **C++**

Object-Menu provides an object-oriented architectural framework for your C++ applications with a dazzling look and feel. Seamlessly port your product between DOS graphics and Microsoft Windows using our interface objects. Our intuitive architecture and natural programming syntax increase your productivity more than you ever thought possible. Our goals are to simplify GUI design for the novice while providing the power and flexibility needed by an expert.

Call today for a free demo!

7 Mountain Rd., Burlington MA 01803
Tel: (617)270-0421 Fax (617)270-4437

BBS (617)270-9552

Circle 341 on Inquiry Card (RESELLERS: 342).

---

**Windows**

**REALTIME VISION**

The software that brings real-time graphics to all Windows users.

With Realtime VISION, you can display real-time data from any Windows software. Set up a DDE link, and VISION will show your data changing in real time. VISION includes the following tools:

- **Display Objects**: TY plots, XY plots, numeric meters, VU meters, gauges, vertical/horizontal bars and lines, filled TY plots.
- **Animation Tools**:
  - Control Objects: toggle switches, pushbuttons, knobs, sliders.
  - Developer's Edition ($95), User's Edition ($195), Student's Edition ($295)

List Price Intro
Realtime VISION $295 $99
Animation Tools $195 $49
Developer's Edition $95 $49

To order, call 1-800-TRY-LABTECH (508) 657-9400 FAX (508) 658-9972

Circle 345 on Inquiry Card.

---

**IS THERE A DOCTOR IN THE HOUSE?**

Nominee Compute Choice Award Best Adult Discovery Software

WINDOWS VERSION

- Dr. Schueler’s Home Medical Advisor gives updated info on diseases, injuries, medical tests, drugs, poisons, nutrition, diets, fitness, and health/travel tips.
- QA format analyzes your symptoms, shows you anatomical displays, and makes over 400 diagnoses.
- Hypertext and SCAN features make finding any topic FAST.
- Low cost updates to all registered users.
- Developed by over 40 physician specialists.

Available in WINDOWS or DOS versions $99.95 Retail
WINDOWS Special: $79.95
DOS Special: $69.95

To order, Call: 1-800-788-2099, Dept. B or see your software dealer

PIXEL PERFECT INC.
10480 S. Tropical Tr.
Merritt Island, FL 32952

Circle 365 on Inquiry Card.
THE BUYER’S MART

A DIRECTORY OF PRODUCTS AND SERVICES

THE BUYER’S MART is a unique classified section organized by product category to help readers locate suppliers. Each ad has Inquiry numbers to aid readers requesting information from advertisers.

AD FORMAT: Each ad will be designed and typeset by BYTE. Do NOT send logos or camera-ready artwork. Ads should furnish typewritten copy. 2”x1 1/4” ads can include headline (23 characters maximum), descriptive text (300 characters is the maximum recommended) plus company name, address, telephone and fax number. 2”x2 1/4” ads have more space for descriptive text (850 characters is the maximum recommended).

DEADLINE: Ad copy is due approximately 2 months prior to issue date. For example: November issue closes on September 8. Send your copy and payment to: THE BUYER’S MART, BYTE Magazine, 1 Phoenix Mill Lane, Peterborough, NH 03458. For more information call: Margot Gnade at 603-924-2656.

Inquiry 701.

RATES (Jan. 1993)

<table>
<thead>
<tr>
<th>Issue</th>
<th>$663</th>
<th>$586</th>
<th>$557</th>
<th>$530</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accessories

**Radioactive?**

Put on your PC with this FM-60 radiation monitor. Serial or parallel port, Detectors: ALPHA + BETA + GAMMA + FAY, Microf. 100’s for high and medium signal. Excellent for training RAIDOS IRS. First sources: New, Version 2.8.

WANDOS, Put Mastercore Centric Ray, Circle of Fonts CallWire to PC magazine review. TBR, on 2.4 GHz. $499.95. Phone order, not available. Full refund.

800-729-5397 or Tel/Fax: (302) 655-5800

Eware Computers Corp.
P.O.Box 4299, Wilmington, DE 19807

Inquiry 702.

**Bar Code Code Readers**

For PC, XT, AT, PS/2, Macintosh and Serial Terminals

- Attaches as 2nd Keyboard or to any AD8 port
- Reads 2D5, 1000 barcode, Code 39, etc.
- External or internal attachment on PC
- 2 Scanners per Reader
- 10+ Configurable Options
- 2 Year Warranty, 30 Day Back Guarantee
- Direct From Manufacturer
- Top Rated by Independent Review
- Complete with Laser Scanner – $1999
- Complete with Stainless Steel Wand – $399

Worthington Data Solutions

Swiss Office
3004 Mission Street
Santa Cruz, CA 95060

904-458-9938

Inquiry 703.

**Custom Keyboards and Terminals**

Engineering, Development and Production
- Point-of-sale • Special purpose • Harm environment
- Access control • Data collection • Operator Input
- Unique • Industrial • Any Interface, key style or size
- No minimum quantity required

Genovation, Inc.
17741 Mitchell North, Irvine, CA 92714

800-922-6333 (714) 633-3359 Fax (714) 633-0322

Inquiry 704.

**Portable Reader**

Simple, Powerful, Easy-to-use

- AA Battery Operated, with backup coin battery
- 2 x 16 Superwist LCD Display
- 32 Raised Rubber Keys
- Real-time Clock Built-in for Date/Time Stamps
- 2 Built-In Inventory Programs
- 3 User Defined Programs, & 3 User Data Files
- Wond, CCD, Laser Scanner Input
- Doubles as Non-Portable Reader
- Serial Interface and Keyboard Interface
- Reads 2D5, UPC/EAN, 128, Code 39, etc.
- Uploads with furnished Programs or Xmodem
- 6K Complete with Steel Wand – $795

Worthington Data Solutions

Swiss Office
3004 Mission Street
Santa Cruz, CA 95060

904-458-9938

Inquiry 705.

**Labeling Software**

On EPSON, IBM, OKI, or LaserJet. Easy WYNNYCO. Any format/size. Up to 125 fields per label. 16 text sizes to 3”-readable at 102, JAAG, Xilfert, Sears, MIL-STD, Penf, 255, 128, UPC/EAN, Code 39. File Input & Scanned PCX graphics – $279. Other programs from $129.

Worthington Data Solutions

(408) 458-9938

Inquiry 706.

**Bar Code Code Readers**

Keyboards emulated for PCX/TXT & PS/2, all clones and any RS-232 Terminal. Transparent to terminals, and HAYES compatible modems. 30-DAY MONEY BACK GUARANTEE.

**American Microsystems**

2190 Regal Parkway, Elks, TX 76040

(800) 648-4452 (717) 571-9015 Fax (717) 685-6322

Inquiry 707.

**Bar Code Printing Software**

- NMPC OCR Systems • Import/Export ASCII etc.
- 1 & 24 pin dot matrix • H-P LaserJetPlus/Series II
- Menu-driven or Memory Resident • Most Label Sizes
- Multiple Densities • Variable Graphic Heights • Code
- 9, 25, UPC A/E, EAN13, 128, 93, 11, MS1/PLES
- BEY, POSTMARK, 2D5/STRIPE

Swiss Office

A 071 87 51 15 Phone

Inquiry 708.

**Bar Code “Specials”**

- Wedges/Portables/Multi On-Line readers with HP wedges
- Spectra Physics lasers $899. PSC & Symbol in stock
- 2 CCDs $608. Mag stripe encoders $148
- Software: print bar codes $99 & read bar codes $199
- J.O.S. – cash drawers $199/receipt printers $999
- 3-Day $33 Back Warranty.”Spanish Dept. available
- OEM/Dealer discount

BARCODE INTERATIONAL SYSTEMS

6190 Palm Canyon Drive, Corona, CA 92879

(714) 277-1917 (800) 653-4352 Fax (714) 277-1005

Inquiry 709.

**Read Bar Codes!**


**Bar Code Code Readers**

Bar codes are easy using our FULL line of readers & printers. They plug and play with your existing CUPS/Intermec/terminals or software systems in your office, store, truck, factory or warehouse. ITS bar code OCR programs print on matrix or laser printers. 30-day refund. 1 year warranty. OEM/VAR dealer discounts.

International Technologies & Systems Corp.
655-K North Berry St., Brea, CA 92621 ·Eastern USA
655-K 1950 A Regal Parkway, Euless, TX 76040 ·Western USA

(800) 228-9487 (714) 990-1880 (804) 741-6725 (FAX) 990-2503

Inquiry 709.

**Portfolio Bar Code Reader**

Bar code reader, operated reader with 64K RAM, 54 key keyboard, real-time clock, 2KX16 LCD display, and built-in laser. Supports WAND, CCD, and LASER. Built-in program generator supports multiple programs and data files, interface to PC & PS2 keyboards, RS-232 terminals, and HAYES compatible modem. 30-DAY MONEY BACK GUARANTEE.

**American Microsystems**

2190 Regal Parkway, Elks, TX 76040

(800) 648-4452 (717) 571-9015 Fax (717) 685-6322

Inquiry 709.

**Easy Bar Code Printing**

The leader in PC Postal bar coding software now provides same easy & flexible barcoding for Code 39.

BARZ OUT – PC memory resident with easy menu select & use. Work with your current programs.

MAKE_BARZ – Easy menu creation of bar code labels.

Save $125 – Limited Time Offer – (Both $125)
30 day $663 $636 $557 $530
3 ads/issue – $530 $554
3 ads/issue – $504 $477

**Bar Code Code Readers**

800-345-4220

Inquiry 709.
DATA INPUT DEVICES

BAR CODE DEVICES

PC BAR CODE SPECIALISTS
Bar Code readers designed for fast, reliable, cost-effective data entry. They emulate your keyboard, so data looks just like it was typed in! Choose from stainless steel wand, laser gun, CCD, and magnetic stripe scanners. Also, powerful label printing software. Great warranty. Generous reseller discounts. 30-DAY MONEY-BACK GUARANTEE.

Seagull Scientific Systems
1527 S.E. 92nd Ave, Portland, OR 97236
1-800-758-2001 206-451-8966
Inquiry 707.

DATA INPUT DEVICES

INQUIRY 708.

COMPUTER BOOKS

COMPUTER BOOKS at a discount
We specialize in ADVANCED books for developers, programmers, computer professionals, engineers, and academics.

Windows, C++, OSI2 2.0, UNIX, Mac, OOP, Analysis/Design, AI, Neural Nets
15% discount on any quantity
Personal service from our computer literate staff
CD-ROM Books in Print lookup service
Special orders, hard-to-find books
Latest books from over 70 publishers
Free 15-page catalog
UPS domestic & international shipping

RealServe
(401) 474-1990 1-800-388-2475

Sangoma Technologies Inc.
(415) 480-6177 Fax: (415) 480-4940
Inquiry 713.

INQUIRY 714.

COMPUTER INSURANCE

INSURES YOUR COMPUTER
SAFEWARE, Computerowner's coverage provides replacement of hardware, media and purchased software. As little as $49 a year covers accidents, theft, power surges and more. One call does it all.

TOLL FREE 1-800-848-3469
SAFEWARE, The Insurance Agency Inc.
PO Box 50211, 7609 N. High St, Columbus, OH 43202
Inquiry 715.

INQUIRY 716.

COMPUTER SYSTEMS

LOW-LOW-LOW
Computer Systems
Notebooks & Network Solutions
IBM-Apple-Compaq
AST-ALR-Ether-Adders
SURAH 368/486 ISA/EISA
AMI/Mpaced Motherboards

• CD ROMS
• Tape Backup
• Pocket FAX/Modem LAN Cards
• Hard Drives/Floppy Drives
• Memory/upgrades
• DRAMS, SIMM Modules
• Laser Printers/Scanners
• Plotters & Digitizers
• Software

SURAH inc.
1-800-543-1001 Nationwide Orders

INQUIRY 717.

DATA CONVERSION

TAPE CONVERSION & DUPLICATION

DVC2000
1/4" Cartridge (AS/400)
4mm DAT

BD2000
1/2" Tape

Miniature, Mini or Micro — popular or obscure. Fixed price quote by return. Standard turnaround 24 Hours.
TEL 1-800-392-6779 FAX 405-321-2741
TEL 44 (0) 734-890042 FAX 44 (0) 734-890040
Vogon Enterprises Ltd.
Unit 5, Forrest Court, Oaklands Park, Fishponds Road, Wokingham, Berks., RG11 2FD, England
Inquiry 718.

INQUIRY 719.

DATA RECOVERY

Ontrack DATA RECOVERY

Ununsualled success rate | Fast turn around | Priority service not available | Cleanroom service
Expertise in DOS, OS/2, Novell, Macintosh, Unix, Xenix, Sun, DEC, Wang.
Banyen Vines and more
MN: 1-800-872-2599  CA: 1-888-752-7557
3971 Bury Drive, Eden Prairie MN 55346
2400 Main Street, Suite 200, Irvine CA 92714
Inquiry 720.
Inquiry 733.

Inquiry 734.

Inquiry 736.

Inquiry 738.

Inquiry 739.

Inquiry 740.

Inquiry 741.

Inquiry 742.

Inquiry 743.

Inquiry 744.

Inquiry 745.

Inquiry 746.

Inquiry 747.

Inquiry 748.
Inquiry 764.

Inquiry 765.

Inquiry 766.

Inquiry 767.

Inquiry 768.

Inquiry 769.

Inquiry 770.

Inquiry 771.

Inquiry 772.

Inquiry 773.

Inquiry 774.

Inquiry 775.

Inquiry 776.

Inquiry 777.

Inquiry 778.

MARKET TO EUROPE!

The BYTE EURODECK offers you a unique opportunity to sell your computer products to BYTE's 50,000 European Subscribers!

Call Jim for more info!

(603) 924-2533
<table>
<thead>
<tr>
<th>Inquiry No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page No.</td>
<td>158-159</td>
<td>193-193</td>
<td>4</td>
<td>334</td>
<td>430</td>
<td>412</td>
<td>367-368</td>
<td>369</td>
<td>369</td>
<td>369</td>
<td>366</td>
<td>348</td>
<td>366</td>
</tr>
</tbody>
</table>
| ** ADVERTISER CONTACT INFORMATION **

To order products or request FREE information, call advertisers directly or send in the Direct Link Card by mail or fax! Let them know you saw it in BYTE!
Fill out this coupon carefully. Please Print.

A. What is your primary job function/principal area of responsibility? (Check one)
   - Computer Hardware
   - Computer Software
   - Business Management
   - Engineering
   - Marketing
   - Sales
   - Information Services

B. What is your level of management responsibility? (Check one)
   - Executive
   - Professional
   - Manager
   - Coordinator
   - Administrative
   - Associate

C. Are you a reseller? (VAR, VAD, Dealer, Consultant?)
   - Yes
   - No

D. What operating systems are you currently using? (Check all that apply)
   - Windows
   - Unix
   - Mac
   - OS/2
   - DOS

E. For how many people do you influence the purchase of hardware or software?
   - Under 10
   - 11-50
   - 51-100
   - Over 100

F. Please send me one year of BYTE Magazine for $24.95 and bill me. Offer valid in U.S. and possessions only.

Inq. Numbers 523-233

1. Circle the Numbers on Your Direct Link Card
   Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address
   Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!
For free product information, mail your completed card today. For quicker response, fax to 1-413-637-4343!

See reverse side for card.

1. Circle the Numbers on Your Direct Link Card
   Circle the numbers which are found on ads and articles in this issue or circle the product category number and receive information on all advertisers listed in that category.

2. Print Your Name and Address
   Answer questions "A" through "E" and mail or fax card to 1-413-637-4343.

3. Product information will be rushed to you from the selected companies!
### YOUR DIRECT LINK

**PRODUCT CATEGORY INDEX**

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on Your Direct Link Card!

To receive information for an entire product category, circle the category number on Your Direct Link Card!

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACCESSORIES/Supplies</td>
<td>151, 1985-4</td>
</tr>
<tr>
<td>2</td>
<td>ADD-IN BOARDS</td>
<td>285, 291, 1985-4</td>
</tr>
<tr>
<td>3</td>
<td>COMMUNICATIONS/NETWORKING</td>
<td>218, 48-49, 1985-4</td>
</tr>
<tr>
<td>4</td>
<td>COMPUTER SYSTEMS</td>
<td>256D-4, 1985-4</td>
</tr>
<tr>
<td>5</td>
<td>DATA ACQUISITION</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>6</td>
<td>DISK &amp; OPTICAL DRIVES</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>7</td>
<td>FAX BOARDS/MACHINES</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>8</td>
<td>GRAPHICS TABLETS/MICE/PEN INPUT</td>
<td>1985-4</td>
</tr>
<tr>
<td>9</td>
<td>KEYBOARDS</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>10</td>
<td>LAPTOPS &amp; NOTEBOOKS</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>11</td>
<td>MAIL ORDER</td>
<td>250, 1985-4</td>
</tr>
<tr>
<td>12</td>
<td>MEMORY/CHIPS/UPGRADES</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>13</td>
<td>MISCELLANEOUS HARDWARE</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>14</td>
<td>MODEMS/MULTIPLEXORS</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>15</td>
<td>MONITORS &amp; TERMINALS</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>16</td>
<td>MULTIMEDIA</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>17</td>
<td>MEMORY, CHIPS, UPGRADES</td>
<td>14-15</td>
</tr>
<tr>
<td>18</td>
<td>COMPUTER AEROSPACE</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>19</td>
<td>COMPUTER HARDWARE</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>20</td>
<td>COMPUTER SOFTWARE</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>21</td>
<td>COMPUTER SYSTEMS</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>22</td>
<td>DATA ACQUISITION</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>23</td>
<td>DISK &amp; OPTICAL DRIVES</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>24</td>
<td>FAX BOARDS/MACHINES</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>25</td>
<td>GRAPHICS TABLETS/MICE/PEN INPUT</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>26</td>
<td>KEYBOARDS</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>27</td>
<td>LAPTOPS &amp; NOTEBOOKS</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>28</td>
<td>MAIL ORDER</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>29</td>
<td>MEMORY, CHIPS, UPGRADES</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>30</td>
<td>MISCELLANEOUS HARDWARE</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>31</td>
<td>MODEMS/MULTIPLEXORS</td>
<td>255, 1985-4</td>
</tr>
<tr>
<td>32</td>
<td>MULTIMEDIA</td>
<td>255, 1985-4</td>
</tr>
</tbody>
</table>

---

**HARDWARE**

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>PERSONAL SOLUTION COMPUTERS</td>
<td>255MV-3</td>
</tr>
<tr>
<td>29</td>
<td>PERSONAL SOLUTION COMPUTERS</td>
<td>255NE-2</td>
</tr>
<tr>
<td>30</td>
<td>PERSONAL SOLUTION COMPUTERS</td>
<td>255DO-3</td>
</tr>
<tr>
<td>31</td>
<td>RECETORIC INC</td>
<td>251, 1985-4</td>
</tr>
<tr>
<td>32</td>
<td>SUN MICROSYSTEMS</td>
<td>16-19</td>
</tr>
<tr>
<td>33</td>
<td>TEXAS MICROSYSTEMS</td>
<td>140-144, B</td>
</tr>
<tr>
<td>34</td>
<td>TEXAS MICROSYSTEMS</td>
<td>145, 1985-4</td>
</tr>
<tr>
<td>35</td>
<td>TRI VALLEY TECHNOLOGY INC</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>36</td>
<td>ULTRA COMPUTERS</td>
<td>255NE-4, H</td>
</tr>
<tr>
<td>37</td>
<td>ZENITH DATA SYSTEMS</td>
<td>404-H, 1985-4</td>
</tr>
</tbody>
</table>

---

**DATA ACQUISITION**

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>MICROSTAR LABORATORIES</td>
<td>267, 1985-4</td>
</tr>
<tr>
<td>39</td>
<td>NATIONAL INSTRUMENTS</td>
<td>1785R-1-2, 1985-4</td>
</tr>
<tr>
<td>40</td>
<td>QIA TECH INC</td>
<td>242, 1985-4</td>
</tr>
<tr>
<td>41</td>
<td>PIONEER COMMUNICATION</td>
<td>95, 1985-4</td>
</tr>
<tr>
<td>42</td>
<td>QUANTUM CORPORATION</td>
<td>190, 1985-4</td>
</tr>
<tr>
<td>43</td>
<td>SAGEN</td>
<td>268, 1985-4</td>
</tr>
<tr>
<td>44</td>
<td>SONY (N.A.)</td>
<td>76-77, 1985-4</td>
</tr>
<tr>
<td>45</td>
<td>TRANTOR SYSTEMS LTD</td>
<td>268, 1985-4</td>
</tr>
</tbody>
</table>

---

**FAX BOARDS/MACHINES**

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>MOTOROLA UDS</td>
<td>965-4, 1985-4</td>
</tr>
<tr>
<td>47</td>
<td>DELL COMPUTER CORP (N.A.)</td>
<td>1985-4</td>
</tr>
<tr>
<td>48</td>
<td>Dell COMPUTER CORP (N.A.)</td>
<td>1985-4</td>
</tr>
<tr>
<td>49</td>
<td>NEC ELECTRONICS</td>
<td>1985-4</td>
</tr>
<tr>
<td>50</td>
<td>NEC ELECTRONICS</td>
<td>1985-4</td>
</tr>
</tbody>
</table>

---

**GRAPHICS TABLETS/MICE/PEN INPUT**

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>C.P. RESEARCH</td>
<td>268, 1985-4</td>
</tr>
<tr>
<td>52</td>
<td>MICROSOFT CORP</td>
<td>57, 1985-4</td>
</tr>
</tbody>
</table>

---

**KEYBOARDS**

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>CHERRY MICROSHALKTER GMBH</td>
<td>210-217</td>
</tr>
<tr>
<td>54</td>
<td>DATALLUX CORP</td>
<td>268, 1985-4</td>
</tr>
<tr>
<td>55</td>
<td>MAYARD, AN ARCHIVE CO</td>
<td>138, 1985-4</td>
</tr>
<tr>
<td>56</td>
<td>MEGADATA</td>
<td>1985-4</td>
</tr>
<tr>
<td>57</td>
<td>MINICOM LTD</td>
<td>965-2, 1985-4</td>
</tr>
<tr>
<td>58</td>
<td>PC POWER &amp; COOLING</td>
<td>91, 1985-4</td>
</tr>
</tbody>
</table>

---

**LAPTOPS & NOTEBOOKS**

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>AER ENERGY</td>
<td>151, 1985-4</td>
</tr>
<tr>
<td>60</td>
<td>AMONIX CORP</td>
<td>268, 1985-4</td>
</tr>
<tr>
<td>61</td>
<td>BITWISE DESIGNS INC</td>
<td>108, 1985-4</td>
</tr>
<tr>
<td>62</td>
<td>IBX SYSTEMS</td>
<td>1760S-4, 1985-4</td>
</tr>
<tr>
<td>63</td>
<td>IBX SYSTEMS</td>
<td>1985-4</td>
</tr>
<tr>
<td>64</td>
<td>MICROCOMPUTER RESEARCH</td>
<td>255HE-2, 1985-4</td>
</tr>
<tr>
<td>65</td>
<td>POLYCOMPUTER, INC</td>
<td>255HE-2, 1985-4</td>
</tr>
<tr>
<td>66</td>
<td>TEXAS INSTRUMENTS</td>
<td>30-31, 1985-4</td>
</tr>
<tr>
<td>67</td>
<td>TOP PC</td>
<td>269, 1985-4</td>
</tr>
<tr>
<td>68</td>
<td>TOSHIBA AMERICA INC</td>
<td>44-45, 1985-4</td>
</tr>
<tr>
<td>69</td>
<td>VORTEX COMPUTERS</td>
<td>255EPC-4, 1985-4</td>
</tr>
<tr>
<td>70</td>
<td>VORTEX COMPUTERS</td>
<td>255FPC-4, 1985-4</td>
</tr>
<tr>
<td>71</td>
<td>ZENITH DATA SYSTEMS</td>
<td>40A-H, 1985-4</td>
</tr>
<tr>
<td>72</td>
<td>ZEOS INTERNATIONAL</td>
<td>135-137, 1985-4</td>
</tr>
</tbody>
</table>
YOUR DIRECT LINK

PRODUCT CATEGORY INDEX

For FREE product information from individual advertisers, circle the corresponding inquiry numbers on your Direct Link Card!

To receive information for an entire product category, circle the category number on your Direct Link Card!

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>PRINTERS/PLOTTERS</td>
<td>Page No.</td>
</tr>
<tr>
<td>192-193</td>
<td>BAY TECHNICAL ASSOC</td>
<td>218</td>
</tr>
<tr>
<td>168</td>
<td>BUFFALO PRODUCTS</td>
<td>203</td>
</tr>
<tr>
<td>49</td>
<td>MINOLTA GMBH (NFL)</td>
<td>108</td>
</tr>
<tr>
<td>107</td>
<td>NEC - PRINTERS</td>
<td>69</td>
</tr>
<tr>
<td>*</td>
<td>PACIFIC DATA PRODUCTS</td>
<td>135</td>
</tr>
<tr>
<td>358-356</td>
<td>TECHNOLOGIC SYSTEMS</td>
<td>270</td>
</tr>
<tr>
<td>140</td>
<td>TEKTRONIX</td>
<td>37</td>
</tr>
<tr>
<td>21</td>
<td>PROGRAMMABLE HARDWARE</td>
<td>Page No.</td>
</tr>
<tr>
<td>400</td>
<td>B&amp;C MICROSYSTEMS</td>
<td>401S-2</td>
</tr>
<tr>
<td>340</td>
<td>IO TECH</td>
<td>270</td>
</tr>
<tr>
<td>358-359</td>
<td>TRIBAL MICROSYSTEMS</td>
<td>271</td>
</tr>
<tr>
<td>361</td>
<td>XILINX</td>
<td>271</td>
</tr>
<tr>
<td>362</td>
<td>2-WORLD ENGINEERING</td>
<td>271</td>
</tr>
<tr>
<td>22</td>
<td>SCANNERS/OCR/DIGITIZERS</td>
<td>Page No.</td>
</tr>
<tr>
<td>564-565</td>
<td>MICROTOCH COMPUTER</td>
<td>256BO-3</td>
</tr>
<tr>
<td>25</td>
<td>SECURITY</td>
<td>Page No.</td>
</tr>
<tr>
<td>352-363</td>
<td>SECURE IT INC</td>
<td>271</td>
</tr>
<tr>
<td>374</td>
<td>WENTECH TECHNOLOGY, INC</td>
<td>271</td>
</tr>
<tr>
<td>23</td>
<td>TAPE DRIVES</td>
<td>Page No.</td>
</tr>
<tr>
<td>68-69</td>
<td>COLORADO MEMORY SYSTEMS</td>
<td>85</td>
</tr>
<tr>
<td>348</td>
<td>LAGUNA DATA SYSTEMS</td>
<td>271</td>
</tr>
<tr>
<td>349</td>
<td>MAYNARD, AN ARCHIVE CO</td>
<td>138</td>
</tr>
<tr>
<td>351</td>
<td>OVERLAND DATA INC</td>
<td>272</td>
</tr>
<tr>
<td>24</td>
<td>UPS</td>
<td>Page No.</td>
</tr>
<tr>
<td>114</td>
<td>MINUTEMAN</td>
<td>99</td>
</tr>
<tr>
<td>115-116</td>
<td>PC POWER &amp; COOLING</td>
<td>91</td>
</tr>
<tr>
<td>29</td>
<td>DATABASE</td>
<td>Page No.</td>
</tr>
<tr>
<td>65-66</td>
<td>BORLAND INTERNATIONAL</td>
<td>13</td>
</tr>
<tr>
<td>76</td>
<td>COMPUTER ASSOCIATES</td>
<td>81</td>
</tr>
</tbody>
</table>

SOFTWARE

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>BUSINESS</td>
<td>Page No.</td>
</tr>
<tr>
<td>75</td>
<td>COMPUTER ASSOCIATES</td>
<td>43</td>
</tr>
<tr>
<td>160-161</td>
<td>FUNK SOFTWARE</td>
<td>103</td>
</tr>
<tr>
<td>371</td>
<td>HARPER COLLINS</td>
<td>266</td>
</tr>
<tr>
<td>377-377</td>
<td>MICROSOFT</td>
<td>272</td>
</tr>
<tr>
<td>420</td>
<td>SIZU RECOGNITA CORP</td>
<td>403S-3</td>
</tr>
<tr>
<td>26</td>
<td>CAD/CAM</td>
<td>Page No.</td>
</tr>
<tr>
<td>568</td>
<td>EVOLUTION COMPUTING</td>
<td>255MW-2</td>
</tr>
<tr>
<td>569</td>
<td>EVOLUTION COMPUTING</td>
<td>256PC-6</td>
</tr>
<tr>
<td>27</td>
<td>COMMUNICATIONS/NETWORKING</td>
<td>Page No.</td>
</tr>
<tr>
<td>160-161</td>
<td>FUNK SOFTWARE</td>
<td>193</td>
</tr>
<tr>
<td>413-414</td>
<td>FUTURESOSFT ENGINEERING</td>
<td>403S-2</td>
</tr>
<tr>
<td>428</td>
<td>MINICOM LTD</td>
<td>90S-2</td>
</tr>
<tr>
<td>500</td>
<td>NASCOM</td>
<td>236</td>
</tr>
<tr>
<td>118</td>
<td>PERSOFT INC</td>
<td>106</td>
</tr>
<tr>
<td>425</td>
<td>WALKER, FICHER &amp; QUINN</td>
<td>403S-1</td>
</tr>
<tr>
<td>28</td>
<td>DATA ACQUISITION</td>
<td>Page No.</td>
</tr>
<tr>
<td>348</td>
<td>NATIONAL INSTRUMENTS</td>
<td>272</td>
</tr>
<tr>
<td>29</td>
<td>DATABASE</td>
<td>Page No.</td>
</tr>
<tr>
<td>65-66</td>
<td>BORLAND INTERNATIONAL</td>
<td>13</td>
</tr>
<tr>
<td>76</td>
<td>COMPUTER ASSOCIATES</td>
<td>81</td>
</tr>
</tbody>
</table>

30 EDUCATIONAL

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>61-62</td>
<td>ABACUS SOFTWARE</td>
<td>183</td>
</tr>
<tr>
<td>135-13</td>
<td>LANDMARK RESEARCH INT'L CORP</td>
<td>123</td>
</tr>
<tr>
<td>96</td>
<td>MATHSOFT INC</td>
<td>188</td>
</tr>
<tr>
<td>360</td>
<td>VISTA MICROSYSTEMS</td>
<td>272</td>
</tr>
</tbody>
</table>

32 ENTERTAINMENT

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>442</td>
<td>CPR COMPUTER DISTRIBUTION GMBH</td>
<td>176S-3</td>
</tr>
<tr>
<td>175</td>
<td>MICROPIC SOFWARE</td>
<td>257</td>
</tr>
<tr>
<td>176</td>
<td>MICROPIC SOFWARE</td>
<td>269</td>
</tr>
<tr>
<td>177</td>
<td>MICROPIC SOFWARE</td>
<td>260</td>
</tr>
</tbody>
</table>

35 MAIL ORDER

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>ALADDIN KNOWLEDGE SYSTEMS</td>
<td>107</td>
</tr>
<tr>
<td>407</td>
<td>COMPUSAVE INTERNATIONAL (INTL)</td>
<td>C31</td>
</tr>
<tr>
<td>408</td>
<td>COMPUTER QUICK</td>
<td>408S-2</td>
</tr>
<tr>
<td>415-416</td>
<td>GREY MATTER LTD</td>
<td>1986S-1</td>
</tr>
<tr>
<td>563</td>
<td>PROGRAMMERS PARADISE</td>
<td>56-91</td>
</tr>
<tr>
<td>567</td>
<td>PROGRAMMERS SHOP</td>
<td>166-168</td>
</tr>
<tr>
<td>570</td>
<td>PROGRAMMERS SHOP</td>
<td>214-215</td>
</tr>
<tr>
<td>571</td>
<td>SOFTWARE CORP</td>
<td>176B-1</td>
</tr>
</tbody>
</table>

36 MATHEMATICAL/STATISTICAL

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>138-139</td>
<td>SYSTAX INC</td>
<td>103</td>
</tr>
</tbody>
</table>

38 ON-LINE SERVICES

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>202</td>
<td>COMPUSERVE</td>
<td>112A-B</td>
</tr>
</tbody>
</table>

39 OPERATING SYSTEMS

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>IBM - OS/2</td>
<td>86-87</td>
</tr>
<tr>
<td>77</td>
<td>MARKETSAMS CO</td>
<td>111</td>
</tr>
<tr>
<td>206</td>
<td>NETWORK COMPUTING DEVICES (N.A.)</td>
<td>71</td>
</tr>
<tr>
<td>125</td>
<td>QUARTERDECK OFFICE SYSTEMS</td>
<td>143</td>
</tr>
</tbody>
</table>

40 PROGRAMMING LANGUAGES/TOOLS

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>182-183</td>
<td>BINK INC</td>
<td>155</td>
</tr>
<tr>
<td>400-403</td>
<td>BORLAND INTERNATIONAL (INTL)</td>
<td>G9V</td>
</tr>
<tr>
<td>74</td>
<td>COMPUTER ASSOCIATES</td>
<td>195</td>
</tr>
<tr>
<td>412</td>
<td>FAST ELECTRONIC GMBH</td>
<td>127</td>
</tr>
<tr>
<td>415-416</td>
<td>GREY MATTER LTD</td>
<td>1986S-1</td>
</tr>
<tr>
<td>369</td>
<td>VERSON SOFTWARE, INC</td>
<td>273</td>
</tr>
<tr>
<td>103</td>
<td>KEDWELL, SCIENTIFIC</td>
<td>988S-1</td>
</tr>
<tr>
<td>102</td>
<td>MICROWAY</td>
<td>160</td>
</tr>
<tr>
<td>102</td>
<td>MICROWAY</td>
<td>224</td>
</tr>
<tr>
<td>120</td>
<td>PHAR LAP SOFTWARE INC</td>
<td>121</td>
</tr>
</tbody>
</table>

41 SECURITY

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>ALADDIN KNOWLEDGE SYSTEMS</td>
<td>107</td>
</tr>
<tr>
<td>65</td>
<td>ALADDIN KNOWLEDGE SYSTEMS</td>
<td>107</td>
</tr>
<tr>
<td>338</td>
<td>DASSOFT INC</td>
<td>273</td>
</tr>
<tr>
<td>136-137</td>
<td>LANDMARK RESEARCH INT'L CORP</td>
<td>123</td>
</tr>
<tr>
<td>124</td>
<td>PKWARE INC</td>
<td>104</td>
</tr>
<tr>
<td>194-195</td>
<td>TOUCHSTONE SOFTWARE</td>
<td>264</td>
</tr>
<tr>
<td>45</td>
<td>UNIX</td>
<td>Page No.</td>
</tr>
<tr>
<td>72-73</td>
<td>GREENVIEW DATA</td>
<td>125</td>
</tr>
<tr>
<td>*</td>
<td>MARK WILLIAMS Co</td>
<td>111</td>
</tr>
<tr>
<td>104</td>
<td>MKS / MORTICE KERN SYSTEMS</td>
<td>182</td>
</tr>
<tr>
<td>206</td>
<td>NETWORK COMPUTING DEVICES (N.A.)</td>
<td>71</td>
</tr>
<tr>
<td>156</td>
<td>SUNSOFT</td>
<td>2-7</td>
</tr>
</tbody>
</table>

47 WINDOWS

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>61-62</td>
<td>ABACUS SOFTWARE</td>
<td>183</td>
</tr>
<tr>
<td>422</td>
<td>CPR COMPUTER DISTRIBUTION GMBH</td>
<td>176S-3</td>
</tr>
<tr>
<td>415-416</td>
<td>GREY MATTER LTD</td>
<td>1986S-1</td>
</tr>
<tr>
<td>341-342</td>
<td>ISLAND SYSTEMS (INTL)</td>
<td>273</td>
</tr>
<tr>
<td>93</td>
<td>KEA SYSTEMS LTD</td>
<td>100</td>
</tr>
<tr>
<td>345</td>
<td>LABTEST</td>
<td>273</td>
</tr>
<tr>
<td>105-106</td>
<td>MICROSOFT CORP</td>
<td>22-27</td>
</tr>
<tr>
<td>110</td>
<td>NAKANO USA CORP</td>
<td>105</td>
</tr>
<tr>
<td>106</td>
<td>PERSOFT INC</td>
<td>106</td>
</tr>
<tr>
<td>365</td>
<td>PIXEL PERFECT / MEDICAL ADVISOR</td>
<td>273</td>
</tr>
</tbody>
</table>

GENERAL

<table>
<thead>
<tr>
<th>Category No.</th>
<th>Inquiry No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>BOOKS/PUBLICATIONS</td>
<td>Page No.</td>
</tr>
<tr>
<td>61-62</td>
<td>ABACUS SOFTWARE</td>
<td>183</td>
</tr>
<tr>
<td>450</td>
<td>BIX</td>
<td>285</td>
</tr>
<tr>
<td>*</td>
<td>COMPUTER</td>
<td>196A-B</td>
</tr>
<tr>
<td>*</td>
<td>PROFESSIONAL'S BOOK SOCIETY</td>
<td>196A-B</td>
</tr>
<tr>
<td>*</td>
<td>PROFESSIONAL'S BOOK SOCIETY</td>
<td>197</td>
</tr>
<tr>
<td>80</td>
<td>DATAPRO INFORMATION SERVICES GROUP</td>
<td>144</td>
</tr>
<tr>
<td>371</td>
<td>HARPER COLLINS</td>
<td>266</td>
</tr>
<tr>
<td>113</td>
<td>MICROSOFT CORPORATION</td>
<td>240A-B</td>
</tr>
<tr>
<td>145</td>
<td>UNIWorld</td>
<td>240A-B</td>
</tr>
<tr>
<td>145</td>
<td>UNIWorld</td>
<td>241</td>
</tr>
<tr>
<td>51</td>
<td>MISCELLANEOUS</td>
<td>Page No.</td>
</tr>
<tr>
<td>*</td>
<td>BYTE SUB MESSAGE</td>
<td>102</td>
</tr>
<tr>
<td>562</td>
<td>INTERMEDIA</td>
<td>266PC-6</td>
</tr>
<tr>
<td>*</td>
<td>PEMCO / UNIFORM SHOW</td>
<td>267C-4</td>
</tr>
</tbody>
</table>

FEBRUARY 1993 • BYTE 283
For more information on any of the companies covered in articles, columns, or news stories in this issue, circle the appropriate inquiry number on Your Direct Link Card. Each page number refers to the first page of the article or section in which the company name appears.
Where Do You Go for Help When You’re the Expert?

BIX is the collective computing power of thousands of hardware and software engineers, independent consultants, systems designers, technology buffs, and computer industry celebrities. With BIX and the people you’ll meet online, you’ll have access to information, software, source code, news reports, and advice. And BIX now offers an optional access program that lets you take advantage of Windows™ while you’re online.*

BIX is a Great Deal!

Subscribe to BIX for only $13 per month! You can access BIX via SprintNet or Tymnet from over 600 locations in the continental US. Connect for only $3 per hour in the evening and on weekends. Daytime rates are $9 per hour. International users: access from many international locations at 9600 bps for $24 per hour using SprintNet.

Join BIX Now!

Using any communications program:
• Dial by modem: 1-800-695-4882
• At “login” enter bix
• At “Name?” enter bix.byte

Further details and rate information will be provided during the toll-free registration.

• Access at 9600 bps with NO SURCHARGE
• Search the full text of BYTE online
• Get quick answers to tough coding questions from industry experts
• Download source code, utilities, & other programs from BYTE
• Chat with other BIX members in real time
• Access via telnet over the Internet - telnet x25.bix.com, then type bix

*Optional Windows™ access program — just $9.95

Money-Back Guarantee: If for any reason you aren’t happy with BIX, simply cancel your account and request a refund of your first monthly fee.

Questions? Call 1-800-695-4775; fax: 617-491-6642; or send Internet mail to: bix@genvid.com

Windows is a trademark of Microsoft Corporation. BIX is a service of General Videotex Corporation; 1030 Massachusetts Avenue, Cambridge, MA 02138. 617-491-3342

Circle 450 on Inquiry Card.
SOFTWARE GLUTONY

Software developers in the personal computer industry have lost their way. They're writing software that's inefficient on today's computers, all the while assuming that tomorrow's computers will be powerful enough to carry the extra burden. This is a serious error. In their rush to provide every imaginable feature in their programs, developers have lost sight of what their customers really want.

A new world of bloated software threatens to consume all computing resources in its path

Not everyone wants to upgrade to tomorrow's hardware, and users are increasingly moving toward notebook computers, which are a step behind today's desktop machines in terms of available resources. These notebook computers must struggle to run today's crop of bloated desktop applications. Given current trends in software development, they will be unable to run the even-bigger software of tomorrow.

If users considered notebook computers ineffective because they lack the capacity to run big software, they might be less likely to buy one. But the truth is that users are more willing to buy a notebook computer than to upgrade an existing desktop computer. Thus, a huge new market is caught in a software catch-22: where buyers wait for notebook computers that are powerful enough to run their new software while software developers bog down hardware with ever-larger applications. Programmers must analyze their audience and the limitations of their preferred hardware. They must create software that is efficient on today's computers or risk losing out to those who do.

Some programmers consider this approach to be an unnecessary limitation on their creative abilities. They are being held back, they say. Their imagination cannot run free in a world of limited memory and CPU power, they say. They're being unrealistic. Gluttony is the mark of a bad programmer.

Good programmers should always follow the principles of elegance, simplicity, economy, and effectiveness in their work. The aesthetics of quality programming require economical use of resources. No matter how fast the CPU, a wasted cycle is a wasted cycle. Programmers must avoid waste by squeezing all the fat from their programs.

Big resource-hogging programs are easy to find. The X Window System once ran fine on a 4-MB Sun-3/50 workstation, but the latest version doesn't perk up until you upgrade to an 8-MB Sparcstation. And you better have 16 MB if you want to run programs using bloated X toolkits like OpenWindows or Motif. The PC world is not immune to such overindulgence. Word processors like Microsoft Word and WordPerfect come stuffed with every imaginable option and gorge themselves on as much as 15 MB of disk space and 4 MB of memory.

The fantastically successful Lotus 1-2-3 offers programmers an instructive example. The original IBM PC version of VisiCalc did not take advantage of the IBM PC's increased capabilities. Microsoft grabbed the opportunity to produce a powerful, full-featured spread-sheet with Multiplan, winning numerous accolades and awards. Lotus 1-2-3 came to market later and without as much fanfare, but it was smaller and faster, and it eclipsed Multiplan almost immediately. Lotus 1-2-3 offered more spreadsheet power by taking the best advantage of the IBM PC.

The moral is to design software that works well today and allows for improvements tomorrow. Then implement the code to work well on today's hardware. The ingenuity, originality, and foresight of your design will become increasingly apparent as it outperforms competitors on forthcoming generations of faster hardware.

Start your work on the smallest, lightest notebook computer you can find, and use all your cleverness, ingenuity, and creativity to write software that makes the best possible use of the resources in the machine. The hardware limits you now, but people can use it today, and you will have a solid foundation for growth.

Now watch as your existing customers tell their friends. The friends who buy the latest hardware with your software will want more. Let your mind wander. What new features can you add to make the best possible use of the new hardware? What clever techniques can you use? What can you do to put yourself another generation ahead of your competitors? Program for your audience, not your ego, and your customers will love you.

Andy Nicholson is a senior programmer/analyst working in network software development at Cray Research (Eagan, MN). You can reach him on BIX c/o "editors" or on the Internet at droid@cray.com.

Stop Bit is a forum for informed opinion on personal computing topics. The opinions expressed are those of the author and not necessarily those of BYTE. Your contributions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

ILLUSTRATION: DAVID JONASON © 1993
NOW THAT WE'RE SO FAR AHEAD OF THE COMPETITION, WE CAN AFFORD TO RELAX A BIT.

Survey was independently conducted by Reliability Ratings, Inc., a subscriber-based research firm that does business with most of the FORTUNE 500.

Dell
800-388-3355
WHEN CALLING, PLEASE REFERENCE #11E91.
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 226-7811.
**THE NEW DELL 425s/L**
i486 SX 25 MHz SYSTEM
$1,749
- LEASE: $65/MO.
- 4 MB RAM
- 120 MB (17 ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 15 MILLION WINMARKS)
- SVGA 1024i MONITOR
[14", 1024 x 768, 28mm]
Up to 65% quicker maintenance.
It's easy to get into this computer. Just loosen a couple of thumbscrews for easy access to the modular chassis.

**The Data Transfer Series**
 • UPGRADEABLE PROCESSOR
 • 120 MB (17 ms) HARD DRIVE
 • ACCELERATED LOCAL BUS VIDEO
 • UPGRADEABLE PROCESSOR

**THE NEW DELL 433/M**
i486 DX 33 MHz SYSTEM
$2,499
- LEASE: $92/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 128 KB EXTERNAL CACHE
- 6 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 20 MILLION WINMARKS)
- SVGA 1024i MONITOR
[14", 1024 x 768, 28mm]
Up to 178% faster video.
Faster PageMaker redlines and lightning-quick Windows repaints. Speed freaks, rejoice.

**THE NEW DELL 450/ME**
i486 SX 50 MHz SYSTEM
$2,999
- LEASE: $111/MO.
- 4 MB RAM
- 170 MB (17 ms) HARD DRIVE
- 4 EISA EXPANSION SLOTS
- 2 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 25 MILLION WINMARKS)
- ULTRASCAN™ 14C MONITOR
[14", 1024 x 768, 28mm, M]
Greater upgradeability.
You can upgrade all the way to the top 486, the 66 MHz DX2. You'll even be able to add the Pentium technology from Intel.

**G U A R A N T E E D**
- **Up to 95% more system performance**. With our new maximized cache as an option, you can give your system a boost whenever you want.

**THE NEW DELL 466/T**
i486 DX2 66 MHz SYSTEM
$3,399
- LEASE: $136/MO.
- 4 MB RAM
- 230 MB (16 ms) HARD DRIVE
- 128 KB EXTERNAL CACHE
- 8 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 1 MB VIDEO RAM (UP TO 29 MILLION WINMARKS)
- ULTRASCAN™ 15F MONITOR
[15", 1024 x 768, 28mm, M]
Guaranteed accountability.
We're the only computer company to guarantee - in writing - compatibility, fast response to your questions, and quick service. Two-thirds of the FORTUNE 500 companies rely on us. So should you.

**Up to 95% more system performance**.
It's easy to upgrade all the way to the top 486, the 66 MHz DX2. If you're still power hungry, you'll even be able to add Pentium technology - the next generation from Intel.

**Up to 50% faster system performance**.
Good thing you don't have to worry about the highway patrol.

**Up to 86% more disk capacity**.
Our floor-standing model has a disk capacity of up to three gigabytes. Makes the Amdahl seem positively cramped.

**33% more slots**.
With eight slots, you can add the network, communication and multiprocessor cards you need for a great low-cost server.

All of the above systems include one floppy drive (3.5" or 5.25"), MS-DOS 6.22 and one-year on-site service.

Each system is custom-built. With 18 different models in our new 486 line - covering 25 MHz, 33 MHz, 50 MHz, and 66 MHz - you can configure just the system you need. In fact, with our complete line of storage, memory, graphics and connectivity products, we can build over 15,000 different configurations.

The data is quoted from a 40-page report available for purchase through Reliability Ratings (601) 444-7575. Reliability Ratings, the research company, is not affiliated with Dell Computer.
AW HELL, LET'S RUN UP THE SCORE.

Our New Performance Series 486 systems have an up to 50% better price/performance ratio than before. Let the blowout begin.

Dell

800-365-8811

WHEN CALLING, PLEASE REFERENCE #11E92.
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-9PM CT SUN.
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.
GET $479 WORTH OF FREE SOFTWARE.  
{ WITHOUT BREAKING ANY COPYRIGHT LAWS. }

The best software money can't buy.  
When you buy our new Dell 425s/L computer, we'll set you up with all this great office productivity software. For free, that is. Free, free, free. Any questions!

Painless upgrades.  
486 upgrades are easy, all the way to the 66 MHz DX2. You'll even be able to add Intel's new Pentium™ technology.

Guaranteed accountability.  
We're the only computer company to guarantee — in writing — compatibility, fast response to your questions, and quick service.

THE NEW DELL®  
425s/L i486™ SX 25 MHz SYSTEM  
$1,899

- LEASE: $70/MO.  
- 4 MB RAM  
- 120 MB (17 MB) HARD DRIVE  
- 3 ISA EXPANSION SLOTS  
- UPGRADEABLE PROCESSOR  
- VGA 1024x768 15-pin (14 inch 1024 X 768, 28mm)  
- 512 KB VIDEO RAM  
- MS-DOS® 5.0  
- MICROSOFT® WINDOWS 3.1  
- MOUSE  
- 2400/9600 FAX MODEM  
- COMMUNICATIONS AND FAX SOFTWARE

**OFFER VALID ONLY ON 425s/L SYSTEMS WITH A CONFIGURATION EQUAL TO OR GREATER THAN ABOVE FEATURED CONFIGURATION. OFFER EXPIRES 2/28/93.

Dell
800-283-1170
WHEN CALLING, PLEASE REFERENCE #11683.
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.
IN MEXICO CITY, 228-7811.